Lower Trent Region Conservation Authority

Lower Trent River: Preliminary Quantitative Human Health Risk Assessment

Submitted by

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Executive Summary

In 1985, the Bay of Quinte was identified as a Great Lakes *Area of Concern* (AOC) by Bi-national Great Lakes Water Quality Agreement between Canada and the United States. The movement of contaminated sediments into the Bay of Quinte from the Trent River has been identified as a potential concern. In preparation for delisting the AOC, the Bay of Quinte RAP Restoration Council had decided (circa 2000) to verify that natural recovery was occurring. As part of this process there is a need to identify the environmental fate of contaminants, possible transport pathways and toxic effects to determine the potential for these contaminants to have adverse effect on human health for recreational users of the Lower Trent River.

As part of the ongoing monitoring work to assess sediment quality and to provide the information necessary to develop an appropriate RAP, the Ontario Ministry of the Environment (MOE) and Environment Canada (E.C.) undertook extensive sediment sampling in 2000 and 2001. This work identified the presence of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) at concentrations that exceeded background sites in the Bay of Quinte. An additional six (6) sediment samples were collected by E.C. in 2004. The PCDD/PCDF levels in these latter samples were among the highest for depositional basin sediments in Lake Ontario and are above the Canadian Council of Ministers of the Environment (CCME) human health-based screening criterion of 4 pg TEQ/g of soil.

In order to complete the actions required under the Canada-Ontario Agreement (COA), a *Preliminary Quantitative Risk Assessment* (PQRA) was used to identify potential human health concerns related to exposures to contaminants in the sediments and surface water in the Lower Trent River and at the mouth of the Trent River. The objective of the PQRA evaluated potential human exposures to PCDD/PCDF and other contaminants in the sediments in the Lower Trent River and in the Bay of Quinte at the mouth of the Trent River that could occur as a result of recreational uses (boating and swimming or wading) of the river and Bay of Quinte in the vicinity of the river mouth. The PQRA also established a *Site-Specific Intervention Level* (SSIL) for sediments. This SSIL represents the maximum PCDD/PCDF concentration (expressed as pg TEQ/g sediment) that could be present in sediments to ensure that exposures would not exceed acceptable levels.

The PQRA compared the concentrations of metals, PCB, polycyclic aromatic hydrocarbons (PAH), organochlorine poesticides and other organochlorine compounds, as well as PCDD/PCDFs, to MOE residential standards to identify contaminants that are present at sufficient concentrations to be considered of potential concern to human health. Based on the screening process, PCDD/PCDF were the only contaminants identified as contaminants of concern.

The PQRA focused on recreational exposures to sediments for children, teens and adults. The potential routes of exposure for these receptors included incidental ingestion of sediment and dermal contact with sediments. Exposure and hazards were evaluated for these pathways for each of the relevant receptors. Infants and preschool-aged children are not expected to come into

contact with sediments in the Lower Trent River or at the river mouth and, therefore, have not been included in the assessment.

The results of the PQRA indicate that exposures to PCDD/PCDF experienced by children, teens and adults do not pose a risk to human health. Based on the results of the risk assessment, a SSIL of 4,300 pg TEQ/g sediment was calculated for the study area. Based upon currently available data, PCDD/PCDF concentrations in sediment in the Lower Trent River and the Bay of Quinte at the mouth of the Trent River do not exceed the SSILs calculated for the receptors considered in the assessment. From the results of the PQRA it can be concluded that:

- Investigations of contaminant concentrations in sediments in the Lower Trent River and in the Bay of Quinte, at the mouth of the Trent River, shows that the maximum concentration of most contaminants are below the levels that would be allowable in residential soil. Therefore, these contaminants do not pose risks for people using the Lower Trent River or the river mouth area for recreational purposes.
- The maximum concentrations of benzo[*a*]pyrene, lead and mercury exceed the limits that would be considered acceptable in residential soil. In all three cases, concentrations that exceed the residential standards are limited to single samples. For all three contaminants, the maximum reported concentrations are marginally above the residential standards. In all other samples, the concentrations of these three contaminants are below the residential standards. Therefore, exposures to these three contaminants across the study area do not represent human health concerns.
- The risk assessment focused on PCDD/PCDF concentrations in the top 20 cm sediment horizon. PCDD/PCDF concentrations exceeded interim residential standards in 34 of 73 samples taken from the top 20 cm horizon. The risk assessment showed that PCDD/PCDF in sediments (in the top 20 cm horizon) in the Lower Trent River and the Bay of Quinte, at the mouth of the Trent River, do not pose a risk to human health for people who use the area for recreational activities such as boating, swimming or wading.
- The maximum PCDD/PCDF concentration reported in the top 20 cm horizon (1,297 pg TEQ/g) is below the SSIL of 4,300 pg TEQ/g calculated for the sediments. The SSIL represents the maximum concentration that could be present in the sediments before exposures for the child receptor could exceed the Hazard Acceptability Benchmark of 0.2
- Review of the PCDD/PCDF concentrations in sediment from below the 20 cm horizon were all below the SSIL calculated in the risk assessment.

Based on the results of the PQRA, the following recommendations can be made:

- Measures to limit human exposures to the sediments in the Lower Trent River and the Bay of Quinte at the mouth of the Trent River are not necessary;

- The results of the PQRA shows that exposures to PCDD/PCDF and other contaminants do not pose a potential risk to human health. Given that the PQRA, which is designed to over estimate potential exposures and the associated risks, indicates that human health

concerns are not present for the study area, the completion of a detailed human health risk assessment to reduce the level of conservatism in the risk assessment is not necessary.

- The presence of single samples, where the concentrations of benzo[*a*]pyrene, lead and mercury exceed residential standards, do not represent hot-spots. Additional investigation to delineate these areas is not required to address potential human health concerns.

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1.0 Introduction

1.1 Background

In 1985, the Bay of Quinte was identified as a Great Lakes *Area of Concern* (AOC) by the International Joint Commission. The movement of contaminated sediments into the Bay of Quinte from the Trent River has been identified as a potential concern. Management of sediments has been identified as part of the remediation effort. Prior to the management of sediments, there is a need to identify the environmental fate of contaminants, possible transport pathways and toxic effects to determine the potential for these contaminants to contribute to the impairment of the Bay of Quinte AOC.

Canada and Ontario, under the *Canada-Ontario Agreement* (COA), are working to understand, restore and protect environmental quality in the Bay of Quinte AOC. As part of this agreement, contaminated sediments in the Lower Trent River must be dealt with in a manner that is deemed appropriate under the COA and the *Remedial Action Plan* (RAP) that has been developed for the Bay of Quinte AOC.

As part of the ongoing monitoring work to assess sediment quality and to provide the information necessary to develop an appropriate RAP, the Ontario Ministry of the Environment (MOE) and Environment Canada (E.C.) undertook extensive sediment sampling in 2000 and 2001. In 2000, sediment cores were collected as part of a comprehensive investigation of sediment quality in the Bay of Quinte. Cores were needed to confirm the quality of sediment at depth in order to update the status of the restrictions on dredging impairment. This work identified the presence of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) at concentrations that exceeded background sites in the Bay of Quinte. An additional six (6) sediment samples were collected by E.C. in 2004. The PCDD/PCDF levels in these latter samples were above the Canadian Council of Ministers of the Environment (CCME) human health-based screening criterion of 4 pg TEQ/g of soil (4.0 pg Toxicity Equivalents/g soil). The CCME soil screening criterion is used to assess sediment quality when evaluating potential human exposures to sediments.

In order to complete the actions required under the COA for the Bay of Quinte *Remedial Action Plan* (RAP), contaminated sediment issues at the mouth of the Trent River must be dealt with to a level deemed appropriate by the RAP. This *Preliminary Quantitative Risk Assessment* (PQRA) will be used to identify potential human health concerns related to direct exposures to contaminants in the sediments and surface water in the Lower Trent River and at the mouth of the Trent River. Indirect exposures to contaminants through such pathways as the consumption of sport fish have not been incorporated into the PQRA. The results of the PQRA will be used in conjunction with other on-going studies to determine the measures necessary to provide adequate protection of human health and the environment.

1.2 Scope and Objectives

The objective of the PQRA is to evaluate potential human exposures to PCDD/PCDF and other contaminants in the sediments in the Lower Trent River and the Bay of Quinte, at the mouth of the Trent River. For the purposes of this assessment, the term PCDD/PCDF is intended to include dioxin-like PCB (DLPCB). The PQRA will also be used to establish a *Site-Specific Intervention Level* (SSIL) for sediments. This SSIL represents the maximum PCDD/PCDF concentration (expressed as pg TEQ/g sediment) that could be present in sediments to ensure that exposures would not exceed acceptable levels. The concept of toxicity equivalents (TEQ) is discussed in Section 2.2.1.5. The PQRA focuses only on recreational activities that could result in people coming into direct contact with sediments in the Lower Trent River or at the mouth of the Trent River.

The PQRA was conducted in accordance with the regulatory guidance provided in Ontario Regulation 153/04 and the associated supporting documentation. Guidance from other regulatory agencies such as Health Canada (Health Canada, 2004) and the U.S. EPA superfund program (USEPA,1989) were used when deemed appropriate.

1.3 Organization of Report

This report is organized into 10 sections and 2 appendices, of which this introduction is the first. Section 2 provides a summary of the environmental and biological monitoring data available for the Lower Trent River area. Section 3 presents the Problem Formulation that identifies the contaminants of concern, the potential receptors and the active or complete exposure pathways. Section 4 presents the results of the Exposure Assessment. Section 5, the Toxicity Assessment, provides a listing of the toxicological reference values used to assess the potential hazards/risks associated with exposure to the contaminants of concern. Section 6 characterizes the risks associated with exposure to contaminants in the sediments for the identified receptors. Section 7 provides a discussion of the uncertainties associated with the hazard estimates from the PQRA. Section 8 provides a summary of the recommendations and conclusions stemming from the PRQA. Section 9 provides a glossary of terms used in this report. Section 10 lists the citations for the reference materials used in the development of the PQRA. Appendix A provides a listing of the soil, sediment and surface water monitoring data that have been used to identify the maximum contaminant concentrations in sediment in the Lower Trent River. Appendix B provides a listing of the sediment quality data for sediment horizons below 20 cm. It should be noted that these data have been provided for completeness and have not been used in the present report.

1.4 Limitation

Risk assessments, by their nature, have inherent limitations and uncertainties. It is believed that these uncertainties have been addressed through the conservative interpretation of site-specific data and parameter selection, and in the conservatism inherent in existing toxicity information. The quantitative estimates of risk provided by this process are valid only for the assumptions and

exposure scenarios outlined in this report. However, should knowledge of the site conditions or toxicity information change, the risk posed by the site may differ from that presented in this report.

This report was prepared exclusively for the purposes, project, and site location outlined in the report. The report is based on information provided to, or obtained by Dillon, as indicated in the report, and applies solely to site conditions existing at the time of the site investigation. Where the risk assessment has relied on information provided to Dillon by the other parties, Dillon has, within the scope and expectations of the risk assessment process, reviewed this data but Dillon does not warrant the accuracy, completeness and representativeness of this information. Dillon's report represents a reasonable review of available information within an established work scope, work schedule, and budget.

This report was prepared by Dillon for the sole benefit and use of the Lower Trent Region Conservation Authority, the Ontario Ministry of the Environment and Environment Canada. The material in it reflects Dillon's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decision made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

2.0 Site Characterization

2.1 Site Description

2.1.1 Site Location and Land Use

An outline of the current study area is provided in Figure 1. The study area includes the Trent River from south of the first navigational lock to the mouth of the Trent River. There are several industries located along the Lower Trent River, particularly along the eastern bank of the river, some of which have discharged, or continue to discharge, directly into the Trent River. Commercial buildings are also present on both sides of the river. A marina is located at the mouth on the eastern side of the river. The river is used for recreational activities and is not used for commercial navigation.

2.1.2 Hydrogeology

The focus of the PQRA is the sediments present in the Lower Trent River and the Bay of Quinte in the immediate vicinity of the mouth of the Trent River. As such, the movement of groundwater or the potential use of groundwater as source of potable water is not an issue for the PQRA. Therefore, a discussion of the hydrogeology of the site has not been included as part of the PQRA.

2.2 Summary of Available Data

Information related to contaminant levels in sediments and surface water has been provided by both the Ontario Ministry of the Environment and Environment Canada. The data used to characterize environmental conditions in sediments and surface water in the Lower Trent River and in the Bay of Quinte at the mouth of the Trent River are summarized in Appendix A (Ontario Ministry of the Environment: unpublished data, 2006, Rachael Fletcher (personal communication) (Environment Canada, unpublished data, 2006, Hans Biberhofer, personal communication). The tables in Appendix A also identify the maximum reported concentration for each of the contaminants listed. The MOE Table 3 standards for residential land use are also provided as screening standards in the sediment quality tables, while the MOE Table 2 standards for potable groundwater are provided for surface water quality tables. Review of the data provided by both agencies has determined that the data are of sufficient quantity and quality and that there were no gaps in the data that would compromise or alter the conclusions of the PQRA. It should be noted that Dillon has used the information as provided by both agencies and has not undertaken independent checking of this data to determine the validity of the data or the accuracy of the reporting by both agencies.

2.2.1 Sediment Quality Data

Both Environment Canada and the Ontario Ministry of the Environment have provided sediment quality data for metals, polychlorinated biphenyls (PCB) and polycyclic aromatic hydrocarbons (PAH). Sediment quality data for organochlorine pesticides and other organochlorine compounds have been provided by the MOE. Sediment quality data for polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF) and dioxin-like PCB (DLPCB) have been

provided by Environment Canada. The analytical data and data sources for each group of contaminants are discussed in the following sections. The PQRA has focused on contaminant concentrations in the top 20 cm of sediment because it is this layer that people can reasonably be expected to be exposed through recreational activities.

Bioturbation (re-suspension of sediments due to fish feeding and/or spawning activities) is typically limited to the depth of habitation by benthic organisms. The majority of benthic species are found in the top 5 cm, while some species, such as oligochaetes, have been found down to depths of 10 cm. Few organisms are able to live at sediment depths greater than 10 cm due to the lack of oxygen (sediments below the top 2 –3 cm are usually anoxic). Fish typically do not spawn in soft sediment areas due to the lack of oxygen and the potential for the eggs to be smothered. Boat owners are typically careful about grounding their boats and will avoid shallow areas. Keel dragging, in the event of an accidental grounding, would be limited to a narrow cut in sediments and re-suspension from this type of event would lead to a limited lateral displacement of sediments.

For reasons outlined above, it is reasonable to expect that people would not typically be expected to come into contact with sediments at depths greater than 20 cm as a result of recreational activities and, therefore, data for depths greater than 20 cm have not been included in the PQRA calculations. For informational purposes, sediment quality data from horizons deeper than 20 cm have been provided in Appendix B of this report.

2.2.1.1 Metals Levels in Sediments

Both the MOE and Environment Canada conducted sediment-sampling programs in the summer of 2005. The results from these sampling programs were provided to Dillon as input data for the PQRA. The MOE and E.C. sampling locations are provided in Figure 2 and Figure 3, respectively. Both figures have been reproduced from figures provided by both agencies. The metals concentration data from these sampling programs were combined to provide an overall summary of metal concentrations in sediments in the Lower Trent River and in the Bay of Quinte, at the mouth of the Trent River. The combined data sets are provided in Appendix A. The maximum concentration of each metal reported is provided in Table 2-1.

Table 2-1: Maximum Reported Metals Concentrations in Sediments

Metal	Maximum Concentration (µg/g)	Metal	Maximum Concentration (µg/g)
Aluminum	20100	Mercury	32.4
Antimony	2.7	Molybdenum	4.2
Arsenic	5.2	Nickel	21.7
Barium	169	Selenium	1
Beryllium	0.77	Strontium	250
Cadmium	1	Thallium	0.292
Chromium	49	Titanium	560
Cobalt	8	Uranium	1.22
Copper	167	Vanadium	41
Lead	231	Zinc	382
Manganese	760		

2.2.1.2 PCB Levels in Sediments

Both the MOE and Environment Canada conducted sediment sampling programs in the summer of 2005. The results from these sampling programs were provided to Dillon as input data for the PQRA. The MOE and E.C. sampling locations are provided in Figure 2 and Figure 3, respectively. Both figures have been reproduced from figures provided by both agencies. The total PCB concentrations data from these sampling programs were combined to provide an overall summary of total PCB concentrations in sediments in the Lower Trent River and in the Bay of Quinte, at the mouth of the Trent River. The combined data sets are provided in Appendix A. The maximum concentration is provided in Table 2-2.

Table 2-2: Maximum Reported PCB_{total} Concentration in Sediments

PCB	Maximum Concentration (µg/g)
PCB_{total}	0.570

2.2.1.3 PAH Levels in Sediments

Results from the sediment sampling programs were provided to Dillon by the MOE and E.C. These data have been used as input data for the PQRA. The MOE and E.C. sampling locations are provided in Figure 2 and Figure 3, respectively. Both figures have been reproduced from figures provided by both agencies. The PAH concentrations data from these sampling programs were combined to provide an overall summary of PAH concentrations in sediments in the Lower Trent River and in the Bay of Quinte at the mouth of the Trent River. The combined data sets are provided in Appendix A. The maximum concentration of each PAH reported is provided in Table 2-3.

Table 2-3: Maximum Reported PAH Concentrations in Sediments

PAH	Maximum Concentration (ng/g)	PAH	Maximum Concentration (ng/g)
Napthalene	150	Pyrene	14600
1-Methylnaphthalene	40.6	Benz[a]anthracene	2820
2-Methylnaphthalene	36.2	Chrysene	2250
Acenapthylene	130	Benzo[b]fluroanthene	1690
Acenapthene	1410	Benzo[k]fluoranthene	1390
Fluorene	1540	Benzo[a]pyrene	1420
Phenanthrene	12100	Indeno[1,2,3-c,d]pyrene	770
Anthracene	1810	Dibenz[a,h]anthracene	120
Fluoranthene	14800	Benzo[ghi]perylene	570

2.2.1.4 Organochlorine Compound Levels in Sediments

Organochlorine pesticides and other organochlorine compounds were evaluated only by the MOE. These data have been used as input into the PQRA. The MOE sampling locations are

provided in Figure 2. The MOE data is summarized in Appendix A. The maximum reported concentrations for organochlorine pesticides and other organochlorine compounds are provided in Table 2-4. It should be noted that all pesticide data provided by the MOE were reported by the MOE as "<W" or no measurable response. In evaluating pesticide concentrations in sediments, the values reported by the MOE as <W were taken to represent the concentrations of these pesticides.

Table 2-4: Maximum Reported Organochlorine Compound Concentrations in Sediments

Compound	Maximum Concentration (µg/g)	Compound	Maximum Concentration (µg/g)
Organochlorine Pesticides		**Other Organochlorine Compounds**	
Heptachlor	1	Octachlorostyrene	2
Aldrin	2	Hexachlorobutadiene	1
pp-DDE	22	1,2,3-tichlorobenzene	2
Mirex	5	1,2,3,4-tetrachlorobenzene	1
α -BHC (hexachlorocyclohexane)	1	1,2,3,5-tetrachlorobenzene	1
β -BHC (hexachlorocyclohexane)	1	1,2,4-trichlorobenzene	2
a-Chlordane	2	1,2,4,5-tetrachlorobenzene	1
γ -BHC (hexachlorocyclohexane)	1	1,3,5-trichlorobenzene	2
g-Chlordane	2	Hexachloroethane	1
Oxychlordane	2	Pentachlorobenzene	1
op-DDT	5	2,3,6-trichlorotoluene	1
pp-DDD	5	2,4,5-trichlorotoluene	1
pp-DDT	5	2,6-dichlorobenzyl chloride	2
Methoxychlor	5	Hexachlorobenzene	1
Heptachlor epoxide	1		
Endosulphan I	2		
Dieldrin	2		
Endrin	4		
Endosulphan II	4		
Endosulphan sulphate	4		
Toxaphene	50		

2.2.1.5 Chlorophenol Levels in Sediments

Results from the sediment sampling programs were provided to Dillon by E.C. These data have been used as input data for the PQRA. The E.C. sampling locations are provided in Figure 3. This figure has been reproduced from figures provided by E.C. The chlorophenol concentrations data from these sampling programs were combined to provide an overall summary of chlorophenol concentrations in sediments in the Lower Trent River and in the Bay of Quinte, at the mouth of the Trent River. The data are provided in Appendix A. The maximum concentration of each PAH reported is provided in Table 2-5.

Table 2-5: Maximum Reported Chlorophenol Concentrations in Sediments

Compound	Maximum Concentration (µg/g)	Compound	Maximum Concentration (µg/g)
2,3,4,6-Tetrachlorophenol	0.25	2,3,5,6-Tetrachlorophenol	0.25
2,3,5-Trichlorophenol	0.25	2,3,4-Trichlorophenol	0.25
2,4-Dichlorophenol	0.25	2,4,5-Trichlorophenol	0.25
2,4-Dimethylphenol	0.5	2,3,6-Trichlorophenol	0.25
2,4,6-Trichlorophenol	0.25	3,4,5-Trichlorophenol	0.25
2,6-Dichlorophenol	0.25	2,3-Dichlorophenol	0.25
4-Chloro-3-Methylphenol	0.5	2,5-Dichlorophenol	0.25
4-Nitrophenol	0.5	3,4-Dichlorophenol	0.25
m/p-Cresol	0.9	3,5-Dichlorophenol	0.25
o-Cresol	0.5	2,4-Dinitrophenol	0.5
Pentachlorophenol	0.25	4,6-Dinitro-2-methylphenol	0.5
Phenol	0.5	4-Chlorophenol	0.25
2,3,4,5-Tetrachlorophenol	0.25	2-Nitrophenol	0.5

2.2.1.6 PCDD/PCDF Levels in Sediments

Both the MOE and E.C. have investigated PCDD/PCDF levels in sediments in the Lower Trent River and in the Bay of Quinte, at the mouth of the Trent River. Summaries of the data for the upper 20 cm horizon are provided in Appendix A. These data represent samples collected by both agencies between 2004 and 2005. A summary of the data from deep sediment horizons is provided in Appendix B. Where available, the PCDD/PCDF data summarized in Appendix A and Appendix B also provide congener analysis for dioxin-like PCBs. For samples where PCDD/PCDF congener concentrations were reported as "<" the method detection limit (MDL), congeners were assumed to be present at ½ the stated MDL and TEQs were calculated assuming a ½ MDL concentration.

The various isomers and congeners of PCDDs, PCDFs and DLPCBs all have the same biological mechanism of action (*i.e.* they all work on the body in the same way). However, they differ in their levels of toxicity. In assessing PCDD/PCDF and DLPCB concentrations in soil, the concentrations of the individual isomers and congeners are converted to a *Toxicity Equivalent* (TEQ) concentration, which effectively expresses the concentration of individual isomers and congeners as functions of its effective concentration relative to the most biologically active congener (2,3,7,8-TCDD) which is assigned a *Toxicity Equivalency Factor* (TEF) of 1.0. The concentrations of the individual PCDD and PCDF isomers and congeners are multiplied by their respective TEF to provide a toxic equivalent concentration or TEQ. For example if the soil concentration of octachlorodibenzo-p-dioxin (OCDD) is reported as 500 pg/g, this is converted to a TEQ concentration by multiplying the reported concentration by the TEF for OCDD (500 pg/g x 0.0001 = 0.5 pg TEQ/g). Similar calculations are completed for each PCDD, PCDF and DLPCB and the TEQ concentrations are summed to provide a total or overall TEQ for the sample. These overall TEQ concentrations are then used in the PQRA to estimate exposure and potential hazards. Several methods exist for converting isomer and congener concentrations into TEQ concentrations. The most commonly used are the *World Health Organization* (WHO) and the *International Toxicity Equivalent Factors* (ITEF) approaches. Although the approaches are similar, differences exist in the relative potencies that are assigned to individual PCDD and

PCDF isomers and congeners. A comparison of the ITEF and WHO TEFs is provided in Table 2-6.

The original data from E.C. have been provided as TEQ concentrations for the individual PCDD, PCDF and DLPCB isomers and congeners using the ITEF TEFs. In assessing the potential human health hazards associated with exposures to PCDD/PCDF, both Health Canada and the Ontario Ministry of the Environment recommend the use of the WHO TEFs. Therefore, it was necessary to convert the ITEF TEQ concentrations reported by E.C. to WHO TEQ concentrations for incorporation into the PQRA. The ITEF TEQ concentrations for the individual isomers and congeners were converted to WHO TEQ concentrations, as shown in Equation 2-1. ITEF TEFs for DLPCB were not provided with the E.C. data, so the concentrations of the DLPCB were not converted to their WHO TEQ equivalent concentrations. While this introduces some uncertainty into the estimated WHO TEQ concentrations, it should be noted that the DLPCB concentrations account for less than 0.01% of the total TEQ. Therefore, the inclusion of the ITEF TEQ concentrations for the DLPCB will not significantly alter the WHO TEQ calculations for PCDD/PCDF. The maximum reported PCDD/PCDF WHO TEQ concentration in sediment (depth < 20 cm) is provided in Table 2-7.

Eq 2-1

$$TEQ_{WHO} = \left(\frac{TEQ_{ITEF}}{TEF_{ITEF}} \right) \times TEF_{WHO}$$

Where:

TEQ_{WHO}	= WHO Toxicity Equivalent Concentration	pg TEQ_{WHO}/g
TEQ_{ITEF}	= ITEF Toxicity Equivalent Concentration	pg TEQ_{ITEF}/g
TEF_{ITEF}	= ITEF Toxicity Equivalent Factor	unitless
TEF_{WHO}	= WHO Toxicity Equivalent Factor	unitless

Table 2-6: Toxic Equivalency Factors for PCDD/PCDF & DLPCB

PCDD/PCDF Isomers & Congeners	WHO TEF Factor	ITEF TEF Factor	DLPCB Isomers & Congeners	WHO TEF Factor
2,3,7,8-TCDD	1	1	PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001
1,2,3,7,8-PnCDD	1	0.5	PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001
1,2,3,4,7,8-HxCDD	0.1	0.1	PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001
1,2,3,6,7,8-HxCDD	0.1	0.1	PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001
1,2,3,7,8,9-HxCDD	0.1	0.1	PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005
1,2,3,4,6,7,8-HpCDD	0.01	0.01	PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001
OCDD	0.0001	0.001	PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1
2,3,7,8-TCDF	0.1	0.1	PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001
1,2,3,7,8-PnCDF	0.05	0.05	PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005
2,3,4,7,8-PnCDF	0.5	0.5	PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005
1,2,3,4,7,8-HxCDF	0.1	0.1	PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01
1,2,3,6,7,8-HxCDF	0.1	0.1	PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001
1,2,3,7,8,9-HxCDF	0.1	0.1		
2,3,4,6,7,8-HxCDF	0.1	0.1		
1,2,3,4,6,7,8-HpCDF	0.01	0.01		
1,2,3,4,7,8,9-HpCDF	0.01	0.01		
OCDF	0.0001	0.001		

Table 2-7: Maximum Reported PCDD/PCDF Concentration in Sediment (0 – 20 cm)

PCDD/PCDF	Maximum Concentration (pg TEQ/g)
PDCC/PCDF	1279

2.2.2 Surface Water Data

Data on surface water quality have been provided by the Ontario Ministry of the Environment. Data were collected during two sampling events (July and November 2005). The sample locations, as provided by the MOE, are summarized in Appendix A. Surface water data were also available for PAH and PCDD/PCDF TEQ. However, the physical-chemical properties of PAH and PCDD/PCDF are such that these compounds will be tightly bound to the sediment particles (these compounds are highly hydrophobic). Thus, the concentrations of these compounds measured in surface water reflect the concentrations of these compounds in sediments re-suspended from the river bed and do not represent the concentrations of these compounds dissolved in the water column. Thus, the mechanisms for exposures to contaminants bound to resuspended sediment particles are the same as those for assessing direct exposure to sediments. The mechanisms for assessing exposure to contaminants dissolved in the water column differ from those used to assess direct exposure to contaminants bound to sediments. Thus, assessing exposures to sediment-bound contaminants through surface water, in addition to assessing direct exposures to sediments effectively double-counts these exposures and is technically incorrect.

Standard risk assessment practice evaluates exposures to PAH and PCDD/PCDF in suspended sediments as exposures to sediments. Because the PQRA will address exposures to PCDD/PCDF and PAH in sediments directly based upon sediment quality data, the suspended sediment data, reported as surface water data, have not been included in the PQRA. The concentrations of dissolved metals reported in surface water have been included. These data are summarized in Appendix A. The concentration data provided by the MOE have been corrected for laboratory blank analyses. In cases where the blank corrected concentrations are reported as less than 0 (negative concentrations), the reported concentrations have been dropped from the assessment. The maximum reported concentration of each metal in surface water is summarized in Table 2-8.

Table 2-8: Maximum Reported Metal Concentrations in Surface Water

Metal	Maximum Concentration (µg/L)	Metal	Maximum Concentration (µg/L)
Arsenic	13	Iron	4430
Selenium	5	Manganese	769
Aluminium	4090	Molybednum	3.67
Barium	301	Nickel	5.94
Beryllium	0.142	Lead	5.69
Cadmium	0.595	Strontium	632
Cobalt	2.34	Titanium	218
Chromium	8.94	Vanadium	18.6
Copper	10.6	Zinc	61.5

3.0 Problem Formulation

The objective of the Problem Formulation stage of the PQRA is to determine which contaminants are present in the environment at levels that may pose a risk to human health and to identify the people (receptors) who could potentially be exposed to the contaminants of concern during recreational activities (boating, swimming or wading).

3.1 Identification of Contaminants of Concern

3.1.1 Identification of Contaminants of Concern in Sediments

The primary focus of the PQRA is the presence of contaminants in the sediment of the Lower Trent River and the Bay of Quinte at the mouth of the Trent River. Regulatory agencies, such as MOE, Health Canada and CCME have not developed human health-based screening guidelines for sediment. The mechanisms that govern human exposure to sediments do not differ from those that govern human exposure to soil. Therefore, standard risk assessment practice assesses human exposures to sediments in the same manner as human exposures to soils. As a result, the use of soil screening guidelines to determine COCs in sediment is appropriate.

The human health-based soil screening guidelines established by the MOE are set to ensure that site-related exposures to contaminants do not exceed 20% of their respective tolerable daily intakes. This is referred to as a *Hazard Index* (HI) of 0.2. When selecting guidelines from other agencies, such as the US EPA, it is necessary to ensure that the adopted screening guideline values be based on the same HI value of 0.2 to maintain consistency with the MOE screening guidelines. The US EPA Region III screening guidelines are based on a HI of 1.0 and an assumed soil ingestion rate of 200 mg/day for a toddler compared to the 100 mg/day used by the MOE in similar risk assessments in Ontario. Therefore, it is necessary to adjust the US EPA Region III values to account for these differences. Screening guidelines from the US EPA have been adjusted as shown in 3-1.

$$EPA_{adj} = EPA_{sv} \times \left(\frac{HI_{MOE}}{HIa} \times \frac{SI_{EPA}}{SI_{MOE}} \right)$$

EQ 3-1:

$$EPA_{adj} = EPA_{sv} \times \left(\frac{0.2}{1.0} \times \frac{200 mg/day}{100 mg/day} \right)$$

$$EPA_{adj} = EPA_{sv} \times 0.4$$

Where:

EPA_{adj}	= Adjusted screening value from EPA	µg/g
EPA_{sv}	= EPA Region III screening value	µg/g
HI_{MOE}	= Hazard Index used by MOE	Unitless
HI_{EPA}	= Hazard Index used by US EPA Region III	Unitless
SI_{EPA}	= Soil ingestion rate used by US EPA Region III	mg/day
SI_{MOE}	= Soil ingestion rate used by MOE	mg/day

The screening guidelines referenced to the US EPA Region III in the sediment screening tables have been adjusted by a factor of 0.4 as outlined above. Two exceptions to this are the screening guidelines used for α-BHC and β-BHC. For these compounds, the US EPA screening guidelines have been used without adjustment. The MOE does not provide screening guidelines for either α-BHC or β-BHC. The MOE screening guideline for γ-BHC is the same as that listed by the US EPA. Therefore, the US EPA screening guidelines for α-BHC and β-BHC have been used without adjustment.

3.1.1.1 Screening for COCs in Sediments: Metals

In the initial stage of the screening process, the maximum concentration reported for each metal in sediment was compared to the MOE (2004) Table 3 standard for residential/parkland use, coarse soils under a non-potable groundwater condition. For those metals for which MOE standards does not exist, Risk-Based Concentrations for residential soils, from the US EPA, Region III, were selected and modified as shown above. The preliminary screening is provided in Table 3-1. Metal exceedances of the respective screening standard are shown in bold.

Table 3-1: Sediment Screening: Metals

Metal	Maximum Concentration (µg/g)	Screening Standards	
		(µg/g)	Source
Aluminium	20100	31200	EPA R III, 2005
Antimony	2.7	40	MOE 2004
Arsenic	5.2	20	MOE 2004
Barium	169	750	MOE 2004
Beryllium	0.77	1.2	MOE 2004
Cadmium	1	12	MOE 2004
Chromium	49	750	MOE 2004
Cobalt	8	40	MOE 2004
Copper	167	225	MOE 2004
Lead	**231**	200	MOE 2004
Manganese	**760**	640	EPA R III, 2005
Mercury	**32.4**	10	MOE 2004
Molybdenum	4.2	40	MOE 2004
Nickel	21.7	150	MOE 2004
Selenium	1	10	MOE 2004
Strontium	250	18800	EPA R III, 2005
Thallium	0.292	4.1	MOE 2004
Titanium	560	124000	EPA R III, 2005
Uranium	1.22	92	EPA R III, 2005
Vanadium	41	200	MOE 2004
Zinc	382	600	MOE 2004

The maximum concentrations of all metals except lead, manganese and mercury, were below their respective residential/parkland standards and would not be considered to be present at concentrations that represent a concern for human exposure. Therefore, these metals are not considered to be contaminants of concern and have not been carried through for further screening or to the exposure calculations in the PQRA.

The maximum concentrations of lead, manganese and mercury exceeded their respective standards. Therefore, these three metals were evaluated further in the screening process to determine if the exceedances noted in the data represented potential concerns. The additional evaluations for lead, manganese and mercury are provided below.

Lead:

Lead concentrations exceeded the residential soil standard of 200 µg/g in only one of thirty-one samples collected from the top 20 cm sediment horizon. The maximum concentration was reported in sample 05-SD01 (5 – 10 cm) (see Appendix A). The lead concentration in the 0 – 5 cm horizon from the same sampling location was reported as 145 µg/g (05-SD01: 0 – 5cm). Ontario Regulation 153/04 (Section 48) and Section 3.3.4.1 of the MOE *Procedures Document* (MOE, 2005) indicate that concentrations from two, or more, samples taken from the same location (defined as being within a 1 metre radius), can be averaged to determine the concentration in the overall sample. Applying this averaging procedure yields an average lead concentration in the top 10 cm of 188 µg/g ((231 + 145)/2). In addition, a review of the sediment quality data from sediment horizons greater than 20 cm shows a lead concentration of 124 µg/g in the 30 – 34 cm horizon at the same sampling location (05-SD01) (see Appendix B). The lead concentration averaged across the 0 – 34 cm horizon, at this location is 167 µg/g. Because the averaged lead concentration at this sample location is below the residential standard of 200 µg/g, the lead concentration at this sampling location is below the level of concern. Thus, lead has not been identified as a contaminant of concern and has not been carried through the PQRA. In addition, the fact that the single lead exceedance is limited to the 5 – 10 cm horizon and that lead concentrations above and below this horizon are below the residential standard, indicates that this single lead exceedance does not represent a hot-spot.

Manganese:

The MOE has not established soil standards for manganese. The screening criterion listed in Table 3-1, represents a screening guideline modified from the US EPA Region III Risk-Based Concentration tables for residential soil. The US EPA Region III residential value is 1,300 µg/g. When modified, as shown in Equation 3-1, a screening criterion of 640 µg/g is derived. Manganese concentrations exceed 640 µg/g in two of thirty-one samples: 760 µg/g in 05-SW01 (0 – 5 cm) and 702 µg/g in 05-PD02 (0 – 5 cm) (see Appendix A). While manganese concentrations in these samples exceeded the modified US EPA Region III screening criterion, both are below typical rural background concentrations of manganese in soil as determined by the MOE (MOE, 1993). Thus, the manganese concentrations noted in the sediment samples collected from the Lower Trent River and the Bay of Quinte, at the mouth of the Trent River, can be considered to be representative of naturally occurring, or background, manganese concentrations. Contaminants that are present at concentrations equal to or lower than the local

background concentrations are not considered to be a concern for human health and are not considered in a human health risk assessment. Thus, because the maximum concentration of manganese is below background soil concentrations, as established by the MOE, manganese has not been considered further in the PQRA.

Mercury:

Mercury concentrations exceeded the residential standard of 10 µg/g in only one of twenty-one samples collected from the top 20 cm horizon. The maximum concentration of 32.4 µg/g was reported in sample 05-SD02 (5 – 10 cm) (see Appendix A). Mercury concentrations in sediments from the 0 – 5 cm and 25 – 30 cm horizon were 0.134 µg/g (05-SD02: 0 – 5 cm) and 0.813 µg/g (05-SD02: 25 – 30 cm), respectively (see Appendix A and Appendix B). Averaging mercury concentrations across all three sediment horizons, yields an averaged concentration of 11.1 µg/g, which marginally exceeds the residential standard of 10 µg/g. The 95th percentile concentration of mercury from the top 20 cm horizon across the study area is 0.246 µg/g, which is well below the residential standard of 10 µg/g. Of the 21 samples within the top 20 cm collected from across the study area, the 05-SD02 (5- 10 cm) sample is the only one where the mercury concentration exceeds 95th percentile concentration. The mercury concentration in this sample is approximately 240-fold higher than the mercury concentration reported in the 0-5 cm horizon immediately above 5 – 10 cm location. It is also more than 130-fold higher than the next highest reported concentration (05PD01: 5- 10 cm) (see Appendix A). The large difference in concentrations between samples that are in close proximity (05-SD02: 0 – 5 cm, 05-SD02: 5- 10 cm and 05-SD02: 25- 30 cm) (between 40-fold and 240-fold) suggests that the mercury concentration reported in 05SD02: 5- 10 cm, may be an anomalous result. This is supported by the large difference in mercury concentration between 05-SD02: 5- 10 cm and the remaining 20 sediment samples from the top 20 cm horizon (more than 100-fold). Therefore, this sample can be removed from consideration in the PQRA. As noted above, the 95th percentile concentration for mercury from the 20 cm sediment horizon from across the study area is 0.246 µg/g. The use of the 95th percentile provides a reasonable maximum estimate of potential exposure for people who can be expected to be exposed to sediments in more than one location across the study area. Because the 95th percentile concentration of mercury is significantly lower than the residential standard, exposure to mercury, through recreational use in the study area, would not be expected to be a potential concern for human health. Therefore, mercury has not been identified as a contaminant of concern and has not been carried through to the PQRA.

3.1.1.2 Screening for COCs in Sediments: PCB

In the initial screening, the maximum reported PCB concentrations in sediment were compared to the MOE Table 3 standard for residential/parkland use. The preliminary screening is provided in Table 3-2. The maximum reported PCB_{total} concentration is below the MOE Table 3 standard for residential parkland use, coarse soils in a non-potable groundwater condition. Thus, PCB concentrations in sediments in the Lower Trent River and river mouth are below levels that would be a concern for human exposure. Therefore, PCB have not been identified as contaminants of concern, and have not been carried through to the PQRA.

Table 3-2: Sediment Screening: PCB

PCB_{total}	Maximum Concentration (µg/g)	Screening Standards	
		(µg/g)	Source
PCB	0.57	5	MOE 2004

3.1.1.3 Screening for COCs in Sediments: PAH

In the initial screening, the maximum reported PAH concentrations in sediment were compared to the MOE (2004) Table 3 standard for residential/parkland use, coarse soils in a non-potable groundwater condition. The preliminary screening is provided in Table 3-3.

Table 3-3: Sediment Screening: PAH

PAH	Maximum Concentration (ng/g)	95th Percentile Concentration (ng/g)	Screening Standards	
			(ng/g)	Source
Naphthalene	150		40000	MOE 2004
1-Methylnaphthalene	40.6		280000	MOE 2004
2-Methylnaphthalene	36.3		280000	MOE 2004
Acenaphthylene	130		1000000	MOE 2004
Acenaphthene	1410		100000	MOE 2004
Fluorene	1540		350000	MOE 2004
Phenanthrene	12100		40000	MOE 2004
Anthracene	1810		28000	MOE 2004
Fluoranthene	14800		40000	MOE 2004
Pyrene	14600		250000	MOE 2004
Benz[*a*]anthracene	2820		40000	MOE 2004
Chrysene	2250		12000	MOE 2004
Benzo[*b*]fluoranthene	1690		12000	MOE 2004
Benzo[*k*]fluoranthene	1390		12000	MOE 2004
Benzo[*a*]pyrene	**1420**	919	1200	MOE 2004
Indeno[1,2,3-*cd*]pyrene	770		12000	MOE 2004
Dibenz[*a*,*h*]anthracene	120		1200	MOE 2004
Benzo[*ghi*]perylene	570		40000	MOE 2004

The maximum reported concentrations for all PAH listed, except benzo[*a*]pyrene, are below the MOE Table 3 standard for residential parkland. The maximum reported concentration for benzo[*a*]pyrene was 1,420 ng/g which exceeds the residential standard of 1,200 ng/g, in a single sample, from the 15 – 25 cm sediment horizon at sample location BQ-10 (see Appendix A). Benzo[*a*]pyrene concentrations in the 0 – 5 cm and 5 – 15 cm horizons from BQ-10 are both 85 ng/g. Averaging benzo[*a*]pyrene concentrations across the 0- 25 cm sediment horizon for BQ-10

yields an average concentration of 530 ng/g, which is below the 1,200 ng/g residential standard. In addition, the 95th percentile concentration for benzo[*a*]pyrene, across the study area, is 919 ng/g, which also is below the residential standard of 1,200 ng/g. Therefore, benzo[*a*]pyrene has not been identified as a contaminant of concern and has not been carried through to the PQRA. As noted above, the maximum reported concentrations of the other PAH are below their respective residential standards and have not been identified as contaminants of concern.

3.1.1.4 Screening for COCs in Sediments: Organochlorine Compounds

In the initial screening, the maximum reported concentrations of organochlorine pesticides and other organochlorine compounds in sediment were compared to the MOE Table 3 standard for residential/parkland use, coarse soils in a non-potable groundwater condition. Where screening standards were not available from the MOE, screening standards from the US EPA were used (US EPA, 2005 Risk-Based Concentration Tables, Residential Soil). Screening standards from the US EPA were adjusted as shown in Equation 3-1. The preliminary screening is provided in Table 3-4. For those organochlorine compounds where screening standards are available, the maximum concentrations are below the screening standards. Therefore, these compounds would not represent potential concerns for human exposure, and these compounds were not identified as contaminants of concern and have not been carried through to the PQRA.

Screening standards are not available for several of the organochlorine compounds listed in Table 3-4. For some of these compounds, such as the trichlorobenzenes and the tetrachlorobenzenes, screening standards are available for one isomer in the group. The maximum reported concentrations of 1,2,4-trichlorobenzene and 1,2,4,5-tetrachlorobenzene are well below their respective screening standards.

The concentrations of the remaining trichlorobenzenes and tetrachlorobenzenes are similar to the concentrations of 1,2,4-trichlorobenzene and 1,2,4,5-tetrachlorobenzene. Therefore, while no screening standards are available for the remaining trichlorobenzenes and tetrachlorobenzenes, it is unlikely that the concentrations represent potential concerns for human exposure. Therefore, these compounds have not been identified as contaminants of concern and have not been carried through to the PQRA. The potential effect that the elimination of these compounds could have on the conclusions of the PQRA is discussed in Section 7 (Discussion of Uncertainties).

The concentrations of the remaining organochlorine compounds are also low and comparable to the levels of the compounds for which screening standards are available. It should also be noted that the concentration of each of these compounds reflects the method detection limits for the analytical procedures. Therefore, the presence of these compounds in sediments in the Lower Trent River and the river mouth has not been confirmed. As a result, these compounds have not been identified as contaminants of concern and have not been carried through to the PQRA.

Table 3-4: Sediment Screening: Organochlorine Compounds

Compound	Maximum Concentration (ng/g)	Screening Standards	
		(ng/g)	Source
Organochlorine Pesticides			
Heptachlor	1	120	MOE 2004
Aldrin	2	50	MOE 2004
pp-DDE	22	1600	MOE 2004
Mirex	5	6400	EPA RIII, 2005
a-BHC (hexachlorocyclohexane)	1	40	EPA RIII, 2005
b-BHC (hexachlorocyclohexane)	1	14	EPA RIII, 2005
a-Chlordane	2	290	MOE 2004
g-BHC (hexachlorocyclohexane)	1	410	MOE 2004
g-Chlordane	2	290	MOE 2004
Oxychlordane	2	N.V.	
op-DDT	5	1600	MOE 2004
pp-DDD	5	2200	MOE 2004
pp-DDT	5	1600	MOE 2004
Methoxychlor	5	4000	MOE 2004
Heptachlor epoxide	1	60	MOE 2004
Endosulphan I	2	290	MOE 2004
Dieldrin	2	50	MOE 2004
Endrin	4	50	MOE 2004
Endosulphan II	4	290	MOE 2004
Endosulphan sulphate	4	290	MOE 2004
Toxaphene	50	232	EPA RIII, 2005
Other Organochlorine Compounds			
Octachlorostyrene	2	N.V.	
Hexachlorobutadiene	1	2400	MOE 2004
1,2,3-tichlorobenzene	2	N.V.	
1,2,3,4-tetrachlorobenzene	1	N.V.	
1,2,3,5-tetrachlorobenzene	1	N.V.	
1,2,4-trichlorobenzene	2	30000	MOE 2004
1,2,4,5-tetrachlorobenzene	1	9200	EPA RIII, 2005
1,3,5-trichlorobenzene	2	N.V.	
Hexachloroethane	1	6300	MOE 2004
Pentachlorobenzene	1	25000	EPA RIII, 2005
2,3,6-trichlorotoluene	1	N.V.	
2,4,5-trichlorotoluene	1	N.V.	
2,6-dichlorobenzyl chloride	2	N.V.	
Hexachlorobenzene	1	460	MOE 2004

3.1.1.5 Screening for COCs in Sediments: Phenols & Chlorophenols

In the initial screening, the maximum reported concentrations of phenol and chlorophenol compounds in sediment were compared to the MOE Table 3 standard for residential/parkland use, coarse soils in a non-potable groundwater condition. Where screening standards were not available from the MOE, screening standards from the US EPA were used (US EPA, 2005 Risk-Based Concentration Tables, Residential Soil). Screening standards from the US EPA were adjusted as shown in Equation 3-1. The preliminary screening is provided in Table 3-5. For those phenol and chlorophenol compounds where screening standards are available, the maximum concentrations are below the screening standards. Therefore, these compounds would not represent potential concerns for human exposure, and these compounds were not identified as contaminants of concern and have not been carried through to the PQRA.

Table 3-5: Sediment Screening: Phenols & Chlorophenols

Compound	Maximum Concentration (µg/g)	Screening Standards	
		(µg/g)	Source
2,3,4,6-Tetrachlorophenol	0.25	920	EPA R III, 2005
2,3,5-Trichlorophenol	0.25	92	EPA R III, 2005
2,4-Dichlorophenol	0.25	10	MOE, 2004
2,4-Dimethylphenol	0.5	140	MOE, 2004
2,4,6-Trichlorophenol	0.25	10	MOE, 2004
2,6-Dichlorophenol	0.25	N.V.	
4-Chloro-3-Methylphenol	0.5	N.V.	
4-Nitrophenol	0.5	N.V.	
m/p-Cresol	0.9	N.V.	
o-Cresol	0.5	N.V.	
Pentachlorophenol	0.25	5	MOE, 2004
Phenol	0.5	40	MOE, 2004
2,3,4,5-Tetrachlorophenol	0.25	N.V.	
2,3,5,6-Tetrachlorophenol	0.25	N.V.	
2,3,4-Trichlorophenol	0.25	10	surrogate
2,4,5-Trichlorophenol	0.25	10	MOE, 2004
2,3,6-Trichlorophenol	0.25	10.	surrogate
3,4,5-Trichlorophenol	0.25	10	surrogate
2,3-Dichlorophenol	0.25	N.V.	
2,5-Dichlorophenol	0.25	N.V.	
3,4-Dichlorophenol	0.25	N.V.	
3,5-Dichlorophenol	0.25	N.V.	
2,4-Dinitrophenol	0.5	4.1	MOE, 2004
4,6-Dinitro-2-methylphenol	0.5	N.V.	
4-Chlorophenol	0.25	N.V.	
2-Nitrophenol	0.5	N.V.	

Screening standards are not available for several of the compounds listed in Table 3-5. For some of these compounds, such as the trichlorophenols screening standards are available for one isomer in the group. This standard has been applied to other isomers in the group. These are indicated a "*surrogate*" in Table 3-5. In these cases, the reported concentrations are well below the screening values (40-fold). Therefore, while no screening standards are available for the remaining trichlorophenols, it is unlikely that the concentrations represent potential concerns for human exposure. As a result, these compounds have not been identified as contaminants of concern and have not been carried through to the PQRA.

The concentrations of the remaining phenol and chlorophenol compounds are also low and comparable to the levels of compounds for which screening standards are available. It should also be noted that the concentration of each of these compounds reflects the method detection limits for the analytical procedures. Therefore, the presence of these compounds in sediments in the Lower Trent River and the river mouth has not been confirmed. As a result, these compounds have not been identified as contaminants of concern and have not been carried through to the PQRA.

3.1.1.6 Screening for COCs in Sediments: PCDD/PCDF

In the initial screening, the maximum reported PCDD/PCDF TEQ concentration in sediment was compared to the MOE recommended interim guideline of 50 pg TEQ/g for PCDD/PCDF in residential soil (coarse-grained) (from ATSDR, 1998). This value is lower than the current MOE Table 3 standard of 1000 pg TEQ/g for PCDD/PCDF and reflects recent changes in the toxicity reference value recommended by the WHO, Health Canada and the MOE. The maximum reported PCDD/PCDF TEQ concentration in the upper 20 cm of sediment is shown in Table 3-6. The maximum TEQ concentration exceeds the interim screening guideline. Therefore, PCDD/PCDF have been identified as contaminants of concern and have been carried through to the PQRA.

Table 3-6: Sediment Screening: PCDD/PCDF

PCDD/PCDF	Maximum Concentration (pg TEQ/g)	Interim Recommended Screening Standards	
		(pg/g)	Source
PCDD/PCDF	**1279**	50	ATSDR, 1998

3.1.2 Identification of Contaminants of Concern in Surface Water

Although the primary focus of the PQRA is the presence of contaminants in the sediment of the Lower Trent River and the Bay of Quinte, at the mouth of the Trent River, potential exposures to metals dissolved in surface water are also of concern. Regulatory agencies, such as the MOE and Health Canada have not developed human health-based screening guidelines for recreational surface water quality. In the absence of guidelines for recreational water use, drinking water guidelines have been used to screen for metals of concern in the water of the Lower Trent River

and the Bay of Quinte, at the mouth of the Trent River. It should be noted that, in selecting screening criteria for surface water, preference was given to drinking water guidelines that were based on human health. Guidelines that are based on protection of aesthetic parameters such as taste, odour or colour have not been considered for this PQRA. Aesthetic parameters are important for the protection of drinking water supplies, where people would be consuming the water on a daily basis. However, they are inappropriate in assessing the potential human health effects that could be associated with intermittent exposures that could result from recreational use of surface water bodies such as the Trent River. Therefore, in cases where Health Canada has developed drinking water guidelines based on aesthetic parameters, a health-based drinking water value from another agency was selected. Drinking water screening criteria for aluminium and iron were selected from the US EPA Region III to replace the aesthetic drinking water quality guidelines established by Health Canada.

The maximum reported concentration of each metal in surface water, and the respective drinking water quality guideline are provided in Table 3-7. Concentrations that exceeded drinking water quality guidelines are shown in bold. Manganese is the only metal that was found to exceed the identified screening criteria. The maximum concentrations of the other metals were below their respective screening criteria and, therefore, were not considered to be contaminants of concern in surface water and have not been carried through to the PQRA.

Table 3-7: Surface Water Screening: Metals

Metal	Maximum Concentration (µg/L)	Screening Standards	
		(µg/L)	Source
Arsenic	13	25	MOE 2004
Selenium	5	10	MOE 2004
Aluminum	4090	37000	EPA RIII, 2005
Barium	301	1000	MOE 2004
Beryllium	0.142	4	MOE 2004
Cadmium	0.595	5	MOE 2004
Cobalt	2.34	100	MOE 2004
Chromium	8.94	50	MOE 2004
Copper	10.6	23	MOE 2004
Iron	4430	11000	EPA RIII, 2005
Manganese	**769**	730	EPA RIII, 2005
Molybednum	3.67	7300	MOE 2004
Nickel	5.94	100	MOE 2004
Lead	5.69	10	MOE 2004
Strontium	632	22000	EPA RIII, 2005
Titanium	218	150000	EPA RIII, 2005
Vanadium	18.6	200	MOE 2004
Zinc	61.5	1100	MOE 2004

Notes:
MOE 2004 -Table 2 Criteria for Potable Ground Water, All Types of Property Use
USEPA (2005) Region III Risk-Based Concentration Tables for Tap Water

Manganese is the only metal that was identified where the maximum concentration exceeded the drinking water quality guideline. Of the sixteen (16) water samples collected by the MOE, manganese exceeded the drinking water quality guideline in only one sample. The maximum concentration of 769 µg/L was reported in sample NORAM 3. The second and third highest reported manganese concentrations are 313 µg/L in sample NORAM2 and 107 µg/L in sample NOR5A, respectively (Appendix A). Manganese concentrations in the remaining 13 samples are below 100 µg/L. In evaluating potential exposures to contaminants in surface water, the use of a single maximum concentration is not representative of potential exposures. A concentration averaged across the study area would provide a more representative concentration upon which to base estimates of exposure. The 95th percentile concentration of manganese in surface water is 427 µg/L (see Appendix A). This value provides a conservative, but reasonable, estimate of manganese concentrations in surface water in the study area. This 95th percentile concentration is below the drinking water screening criterion of 730 µg/L. Therefore, manganese is not considered to be a contaminant of concern in surface water and has not been carried through to the PQRA. It should also be noted that drinking water criteria are based on the assumption that a person would be drinking the water on a daily basis over the course of a lifetime. Thus, the application of these screening criteria to the identification of contaminants of concern in surface water represents a conservative approach because people would not be consuming the water from the study area on a daily basis, nor would their consumption of this water be equal to the consumption of drinking water.

3.2 Identification of Potential Receptors

The Lower Trent River study area incorporates the Trent River from south of the first navigational lock to the river mouth. This area would be considered as recreational/parkland. As noted in Section 1 and Section 2, the focus of the PQRA is the assessment of the potential hazards and/or risks associated with exposure to contaminants of concern (primarily PCDD/PCDF) in sediments that could result from recreational use of the Lower Trent River and river mouth area. Thus, the people who can reasonably be expected to come into contact with sediments through the recreational use of the study area include:

- Children (5 years through 11 years of age)
- Teens (12 years through 19 years of age)
- Adults (20+ years of age).

Infants (0 to 6 months of age) would not be expected to come into contact with sediments in the Lower Trent River or the river mouth. The Lower Trent River and the Bay of Quinte, at the mouth of the Trent River, is not an area where preschool-aged children (7 months through 4 years of age) would be engaged in swimming or wading activities. Opportunities for wading do not exist on either bank of the river within the study area. In addition, information provided to Dillon by Environment Canada and the MOE indicates that while boat launches are present in the upper regions of the study area, the river bottom in this area is heavily scoured and little sediment is present. While wading is possible in these areas, opportunities for contact with sediment are very limited. At the marina docks, it is extremely unlikely that very young children

would be allowed to jump into the water. In addition, opportunities for wading in this area would also be expected to be limited. Therefore, these receptors have not been included in the PQRA.

3.3 Site Conceptual Model

In general, the PCDD/PCDFs in the study area are bound to sediment particles. Therefore, exposure to PCDD/PCDFs will depend on the amount of contact that a person could have with sediment in Lower Trent River or river mouth areas. The human health conceptual site model, presented in Figure 4 provides a summary of the potential ways that people using these areas could come into contact with PCDD/PCDFs in the study area. For recreational users of the Lower Trent River and river mouth areas, the potential exposure pathways include:

- Incidental ingestion of soil/sediment; and
- Dermal contact with soil/sediment.

Rationales to support the selection of potentially complete exposure pathways and the exclusion of potentially incomplete exposure pathways are provided in Table 3-8.

Table 3-8: Potentially Complete Exposure Pathways: Lower Trent River Study Area

Media	Exposure Route	Pathway	Retained	Rationale
Sediment	Inhalation	Inhalation of re-entrained sediment	No	Re-entrainment of sediments into the air column is not a potentially complete exposure pathway.
	Ingestion	Incidental ingestion of soil/sediment	Yes	Incidental ingestion of sediment is a potentially complete exposure pathway.
		Uptake into plants and consumption of plants	No	People are not expected to consume plants from the area.
		Uptake into animals and consumption of animals	No	Recreational fishing is addressed under the Ontario Sport Fish Guide.
	Dermal Contact	Dermal contact with sediment	Yes	Dermal contact with sediment is a potentially complete exposure pathway.
Surface Water	Ingestion	Incidental ingestion of surface water while swimming/wading	No	PCDD/PCDFs are essentially insoluble in water. Ingestion of PCDD/PCDFs while swimming would be expected to be limited. In addition, PCDD/PCDFs, suspended in the water column, will be associated with suspended sediment particles. Therefore, these exposures will be effectively evaluated under the incidental ingestion of soil/sediment pathways.
	Dermal Contact	Dermal contact with surface water while swimming of wading		

4.0 Exposure Assessment

4.1 Receptor Characteristics

4.1.1 Physical and Physiological Factors

Physical and physiological factors such, as body weight and inhalation rates, and behavioural factors, such as the consumption of soil, all affect the potential daily exposures experienced by each of the receptors considered in the PQRA. Physical and physiological parameters are available from a number of sources including the MOE, Health Canada and the US EPA. The MOE has recently completed a review of available parameters and has identified values that it has used in assessing potential exposures to contaminants in the environment (MOE, 2002). The parameters used to assess exposures to PCDD/PCDFs in soil and sediments are summarized in Table 4-1.

Table 4-1: Physical, Physiological and Behavioural Parameters

Parameter	Units	Infant	Preschooler	Child	Teen	Adult	Reference
Age Range		0-6 m	7 m - 4 yrs	5 - 11 yrs	12-19 yrs	>20yrs	MOE, 2002
Years within an Age Group	years	0.5	4.5	7	8	50	MOE, 2002
Body Weight	kg	8.2	16.5	32.9	59.7	70.7	MOE, 2002
Soil Ingestion Rates	g/day	0.02	0.1	0.1	0.02	0.02	MOE, 2002
Daily Inhalation Rates	m^3/day	2.1	9.3	14.5	15.8	15.8	Health Canada, 2004
Drinking Water Ingestion	L/day	0.3	0.6	0.8	1	1.5	Health Canada, 2004
Skin Surface Area							
Hands	cm^2	320	430	590	800	890	MOE, 2002
Upper & Lower Arms	cm^2	550	890	1480	2230	2500	MOE, 2002
Upper & Lower Legs	cm^2	910	1690	3070	4970	5720	MOE, 2002
Totals	cm^2	1780	3010	5140	8000	9110	MOE, 2002
Total Body Surface Areas (for Dermal Contact)							
Total Body Surface Area	cm^2	3740	6190	10130	15920	18940	Richardson, 1997
Soil Loading to Skin							
Hands	g/cm^2/day	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	Health Canada, 2004
Other Surfaces	g/cm^2/day	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	Health Canada, 2004
Averaged Loading	g/cm^2/day	4.0E-05	4.0E-05	4.0E-05	1.9E-05	1.9E-05	Calculated[1]

1: Averaged loading for the teen and adult receptor have been calculated as a weighted average based on the soil loadings to hands and other surfaces recommended by Health Canada. The loading factors for the infant, preschooler and child are based on the central tendency estimate of soil loading factors recommended by the US EPA (US EPA, 2004).

The parameters listed in Table 4-1 have been used to assess potential human exposures in the PQRA for the Lower Trent River and river mouth study area. In addition, Health Canada has recently updated its estimates of soil-loading factors for soil adhesion to skin. These soil-loading factors recognize differences in soil loading to skin that exist between hands and other parts of the body. These values are more recent than those used by the MOE in 2002 and reflect recent investigations conducted in the US (USEPA, 2004.). Therefore, the Health Canada soil-loading factors have been used to calculate a weighted average soil-loading factor for exposed body areas for the teen and adult receptors. These values, shown as the *Averaged Loading Factors* in Table 4-1, have been used to estimate dermal exposure to PCDD/PCDFs in soil and sediment from the various study areas considered in this assessment. For the child receptor, a soil-loading factor of

0.04 mg/cm^2 (0.00004 g/cm^2), recommended as a *Central Tendency Estimate* (CTE) by the US EPA has been used to estimate potential dermal exposures (USEPA, 2004).

4.1.2 Receptor Activity Patterns

The level of exposure that a person could experience through participating in recreational activities in the Lower Trent River and/or river mouth depends on the amount of time a person spends in these areas. The length of time a person could be expected in the area was based on by the activity patterns that are assumed for each of the identified receptor groups considered in the assessment. Health Canada provides generic exposure duration and exposure frequency assumptions for several land-use categories including agricultural, residential, commercial and industrial sites (Health Canada, 2004). However, the guidance for residential or commercial land-use does not adequately describe the amount of time that a person could spend in the study area for recreational activities. The Ontario Ministry of the Environment also does not provide generic guidance on exposure frequency and duration assumptions for recreational or parkland use. Therefore, it is necessary to develop exposure frequency and duration assumptions based on best professional judgement. The activity pattern assumptions used to estimate the potential exposure for people engaged in various recreational activities in the study area are provided in Table 4-2. These estimates are based on professional judgement and on information provided to Dillon by members of the Trent River Mouth Investigation Steering Committee.

Table 4-2: Activity Pattern Assumptions for Swimmers & Waders in Lower Trent River

Receptor	Age Group	Activity Pattern Assumptions
Infant	0 – 6 months	Infants and preschool children would not be expected to wade in Lower Trent River and, therefore, would not be expected to come into contact with sediments. Potential exposures to PCDD/PCDFs as a result of swimming or wading have not been assessed for the infant or preschool child.
Preschool Children	7 months – 4 yr	
Child	5 yr – 11 yr	School-aged children and teens are likely to spend the greatest amount of time swimming or wading in the Lower Trent River or the river mouth area. For the purposes of this assessment, it has been assumed that school-aged children, teens and adults could spend up to 2 hours per day, 2 days per week (weekends) 16 weeks per year, swimming or wading in the Lower Trent River or river mouth area. A period of 16 weeks was set to coincide with the summer months (June through September). Before June and after September, it is assumed that the water temperature in the river would discourage swimming and wading.
Teen	12 yr-19 yr	
Adult	20+ yr	

In order to provide exposure estimates for all receptors that are representative of the local conditions, assumptions regarding potential frequencies for direct contact with sediment must be adjusted to account for the period of the year when access is restricted due to water temperatures or when the river is frozen and access to sediment would not be possible. For the purpose of this assessment, cold weather climactic conditions that limit exposure to contaminants in sediments were assumed to persist for 36 weeks per year, leaving 16 weeks per year when direct exposure to sediment would be possible.

4.1.3 Exposure Averaging Factors

The toxicity reference values (TRVs) developed by regulatory agencies are averaged daily exposure values and represent daily exposures that can occur over a life-time without resulting in adverse human health effects or unacceptable increases in life-time cancer risk. The exposures to contaminants in the sediments of the Lower Trent River, experienced by members of the local community that use the Lower Trent River and river mouth area for recreational activities, are considered to be intermittent exposures, because exposures will only occur on the days when people are in the river. Before these intermittent exposures can be compared to the appropriate toxicity values, the intermittent exposures must be adjusted to account for the differences in exposure duration between the intermittent exposures on the lands in the study area and the continuous exposures that were assumed in the development of the toxicity values. The difference in exposure duration is calculated as an *Exposure Averaging Factor* (AF). The activity patterns listed in Table 4-2 have been used to calculate the averaging factors for each of the receptor groups considered in the PQRA.

The calculation of exposure averaging factors depends on the type of exposure being considered. For example, inhalation occurs on a continuous 24-hour basis regardless of whether a person is on-site or off-site. Therefore, the inhalation exposure experienced by people on a site is a function of the both the time spent on-site in a given day and the number of days spent on-site in a given year. Exposures of this nature are considered *Time Driven*. Exposures such as the incidental ingestion of soil or sediment or dermal contact with soil or sediment can only occur when a person is present on-site. These exposures are considered to be *Event Driven*. A discussion of the calculation of the *Event Driven* exposure averaging factors is provided below.

4.1.3.1 Event-Driven Exposure Averaging Factors

The calculation of *Event Driven* averaging factors is a function of the number of days spent in the study area in a given year. Because scientific information relating to the apportionment of exposures between on-site and off-site sources is limited, the risk assessment process conservatively assumes that on the days that a person is on-site, all of the daily incidental ingestion of soil, or other direct contact exposures, occurs while on-site. The calculation of the AF for *Event Driven* exposures is based on the number of days exposures are assumed to occur compared with the number of days in a given year. The AF for *Event Driven* exposures is calculated as shown in Equation 4-1.

Eq 4-2: Calculation of Exposure Averaging Factor for *Event Driven* Exposures

$$AF = \frac{\left(EF_n \times EW_n\right)}{\left(365 \, {}^{days}\!/\!_{year}\right)}$$

Where:	AF	= Averaging Factor	Unitless
	EF_n	= Exposure Frequency for receptor "n"	days/week
	EW_n	= Weeks per year on-site for receptor "n"	weeks/year

4.1.3.2 Calculating Exposure Averaging Factors

Exposure averaging factors for *Event Driven* exposures for people engaged in the recreational activities as identified in Table 4-2 are provided in Tables 4-3. The averaging factors presented in the following tables have been calculated using the event-driven exposure averaging factor equation presented above. The calculated exposure averaging factors (AFs) have been used to estimate yearly-averaged daily exposures for each of the identified receptors.

Table 4-3: Exposure Averaging Factors for Recreational Receptors

Receptor	Days per week	Weeks per year	Days per year	AF
Child	2	16	365	8.77E-02
Teen	2	16	365	8.77E-02
Adult	2	16	365	8.77E-02

4.2 Estimating Exposure to PCDD/PCDF Within the Study Area

This section provides an overview of the calculations used to estimate exposures for each of the potentially complete exposure pathways including:

- Incidental ingestion of soil and/or sediment, and
- Dermal contact with soil and/or sediment.

Summaries of the equations used to calculate exposure for the incidental ingestion of sediment and dermal contact with sediment are provided in Section 4.2.1 and Section 4.2.2, respectively.

4.2.1 Incidental Ingestion of Sediment

The mechanisms that govern human exposure to sediments do not differ from those that govern human exposure to soil, and standard risk assessment practice assesses human exposures to sediments in the same manner as human exposures to soil. Exposure to contaminants in sediment depends on the concentration of the contaminants in the sediment, the amount of sediment ingested on a daily basis and the number of days per year that exposures are likely to occur. The estimated daily intake of contaminants through the incidental ingestion of sediment is calculated as shown in Equation 4-2. For the purposes of this assessment, it has conservatively been assumed that, on the days when people are in one of the areas of interest, all sediment ingested on that day comes from that area. Thus, soil or sediment ingestion exposures are considered to be *event driven* exposures.

Eq 4-2:

$$EDI_{si} = \frac{Csed \times IR_{sed} \times CF \times BAF \times AF}{BW}$$

Where:

Parameter	Description	Units
EDI_{si}	= Intake from incidental ingestion of soil/sediment	mg/kg-day
C_{sed}	= Concentration of contaminant in soil/sediment	mg/kg
IR_{sed}	= Daily soil/sediment ingestion rate	g/day
CF	= g to kg conversion factor	0.001
BAF	= Bioaccessibility Factor	unitless
AF	= Exposure averaging Factor	unitless
BW	= Receptor body weight	kg

Before the body can absorb a contaminant that is bound to a sediment particle, the contaminant must first be released from the particle into the fluids in the digestive tract. If contaminants that are tightly bound to sediment particles are not released from the sediment particles in the digestive tract, they are not available for absorption into the body. As a result, contaminants that remain bound to sediment particles do not contribute to the potential exposure of the individual. Assuming that 100% of the PCDD/PCDFs TEQ concentrations reported in sediment particles is released from these particles and is available for absorption will overestimate potential exposures.

The bioavailability of PCDD/PCDF in contaminated soils has been reviewed (USEPA, 2003). The estimated oral absorption of ingested 2,3,7,8-TCCD in soil administered to animals in solvent or oily vehicles is reported to range from 20% - 40%. In studies where the PCDD/PCDF contaminated soil was administered in aqueous vehicles (a more realistic situation), the estimate drops to 20% - 26%. Bioaccessibility is an *in vitro* technique to assess the amount of PCDD/PCDF released from soil or sediment particles in the digestive tract. The amount of PCDD/PCDF released from sediment particles in the digestive tract represents the bioaccessible fraction. Studies of PCDD/PCDF bioaccessibility from various soil types are limited and reviewed by Ruby *et al.,* 2002. This study, which investigated PCDD/PCDF bioaccessibility in floodplain soils, identified a potential bioaccessibility that ranged between 25% and 34% (Ruby *et al*, 2002). These studies were conducted on soils with low organic content and, therefore, the PCDD/PCDFs would not be as tightly bound as they would be on soil/sediment particles with higher organic contents. For the purposes of the PQRA, the upper limit of the bioaccessibility range reported by Ruby (34% or 0.34) was selected to estimate potential bioaccessibility. It is likely that the organic content of the sediment in the Lower Trent River and river mouth have a higher organic content than the soils used by Ruby *et al.* (Ruby, *et al,* 2002). Therefore, the use of the 0.34 bioaccessibility factor will result in potential incidental sediment ingestion exposures that are protective of human health.

For waders, incidental ingestion of sediment would not be expected to occur as a result of the incidental ingestion of surface water. Rather, for waders, sediment ingestion would be expected to occur as a result of hand-to-mouth activity. Therefore, the soil ingestion rates listed in Table 4-1 have been used to assess incidental ingestion for people engaged in wading activities. While swimming, incidental ingestion of sediment is most likely to occur as a result of the incidental ingestion of surface water that contains suspended sediment particles. To assess incidental ingestion of sediment while swimming, it is necessary to know how much sediment is suspended

in the water column and how much water people typically ingest while swimming. In assessing incidental sediment ingestion at other sites, the MOE has used an incidental surface water ingestion rate of 50 ml (0.05 L) per event (Welsh *et. al*, 2005). These assumptions provide an estimated sediment ingestion rate of 1 mg sediment per event. This is significantly lower than the incidental soil ingestion rates assumed for the wader. Therefore, to ensure that conservative exposure estimates are developed for swimmers, the incidental soil ingestion rates listed in Table 4-1 have been used to assess incidental sediment ingestion while swimming. Exposure estimates for incidental sediment ingestion for the child, teen and adult recreational swimmers and waders in Lower Trent River and river mouth are provided in Table 4-4. As noted in Section 4.1.2, infants and preschool-aged children would not be expected to be involved in either wading or swimming. Therefore, these receptors have not been included in the evaluation of exposures to PCDD/PCDF in sediments in the Lower Trent River.

Table 4-4: Incidental Ingestion Exposures to PCDD/PCDF in Sediments

Swimmers and Waders in Lower Trent River						
Receptor	**Concentration in Soil**	**Soil Ingestion Rate**	**Bioaccessibility**	**Exposure Averaging Factor**	**Body Weight**	**Estimated Daily Intake**
	pg/g	**g/day**	**Unitless**	**Unitless**	**kg**	**pg/kg-day**
Child	1279	0.1	0.34	0.09	32.9	0.12
Teen	1279	0.02	0.34	0.09	59.7	0.013
Adult	1279	0.02	0.34	0.09	70.7	0.0111

4.2.2 Dermal Contact with Sediment

The uptake of contaminants from sediment through the skin depends on the concentration of the chemical in the sediment, the surface area of skin exposed to sediments on a daily basis, the amount of sediment that adheres to the skin and the permeability of the skin to the contaminant. The estimation of the daily exposures to contaminants from dermal contact with sediment is calculated as shown in Equation 4-3. For the purpose of this assessment, it has been conservatively assumed that on the days when a person is in one of the areas of interest, all dermal contact with sediment is derived from the sediment on the site. Thus, dermal contact exposures are considered to be *event driven* exposures. The averaging factors used to assess event driven exposures for dermal contact with soil and sediment are provided in Section 4.1.3.2 for each of the receptors considered for each area of interest. The results have been used in conjunction with the exposure estimates for the other contributing pathways to develop overall estimates of exposure to the PCDDs/PCDFs in the areas of interest.

Eq 4-4:
$$EDI_{dc} = \frac{C_{sed} \times SA \times SLF \times DAF \times CF \times AF}{BW}$$

Where:

Parameter	Description	Units
EDI_{dc}	= Intake from dermal contact with soil/sediment	mg/kg-day
C_{sed}	= Contaminant concentration in soil/sediment	mg/kg
SA	= Surface area of exposed skin	cm^2
SLF	= Soil/Sediment Loading Factor	g/cm^2-day
DAF	= Dermal absorption factor	unitless
CF	= g to kg conversion factor	0.001
AF	= Exposure averaging factor	unitless
BW	= Receptor body weight	kg

The sediment-loading factor represents the amount of sediment that adheres to the skin over a given surface area. The calculated sediment loading factors used in the present assessment are provided in Table 4-1. The loading factors are based on soil adhesion to the skin. It is reasonable to expect that a greater amount of sediment could adhere to the skin given that, in general, sediment would be expected to be wetter than soil. Although a thicker layer of sediment may adhere to skin than soil, the area covered by soil and sediment can be expected to be the same. The uptake of contaminants from soil or sediment through the skin is governed by the layer of soil/sediment that is in direct contact with the skin. Contaminants in soil/sediment that are not in direct contact with the skin do not contribute to dermal uptake. Therefore, using soil-loading factors to estimate uptake from sediments will provide reasonable estimates of potential exposure.

The uptake of chemicals through the skin is chemical-specific. The dermal absorption factor of 0.03, recommended by the US EPA, has been used to estimate dermal exposures to PCDD/PCDFs (USEPA, 2001).

For people who wade in the Lower Trent River, dermal contact with sediment is most likely to occur on the feet and lower legs. It is also possible that people's hands and forearms could come into contact with sediments as a result of activities where people lift items from the sediments along the shore. To provide a conservative estimate of potential dermal contact, it has been assumed that while wading, hands, upper and lower arms, and upper and lower legs, would come into contact with sediments. Although this does not include the feet, assuming that upper arms and upper legs would come into contact with sediments will provide a larger skin surface area for sediments adhesion than assuming just the feet, lower legs and hands would come into contact with sediments. Thus, this approach will provide a conservative estimate of dermal exposure.

People who swim in the Lower Trent River or the river mouth would be expected to come into contact with sediments suspended in the water column. However, these sediments would not be expected to adhere to the skin until the person leaves the water. Upon leaving the water, there is a potential for sediments to adhere to the skin over much of the body. However, it is unlikely that sediments that adhere to swimmers would completely cover the skin surface area. Information on the amount of sediment that adheres to swimmers upon leaving the water is not available. Assuming that the entire body is covered in a mono-layer of sediment particles will over-estimate potential dermal exposures for these receptors. For the purposes of this assessment, it

has been assumed that hands, upper and lower arms, and upper and lower legs would be covered in a mono-layer of sediment upon leaving the water[1]. This represents approximately 50% of the total skin surface area for the child, teen and adult receptors (see Table 4-1). Thus, this will provide conservative estimates of dermal contact with sediments for swimmers.

Exposure estimates for dermal contact with sediment for the child, teen and adult recreational swimmers and waders in the Lower Trent River and river mouth are provided in Table 4-5. As noted in Section 4.1.2, infants and preschool-aged children would not be expected to be involved in either wading or swimming. Therefore, these receptors have not been included in the evaluation of exposures to PCDD/PCDF in sediments in the Lower Trent River.

Table 4-5: Dermal Contact Exposures to PCDD/PCDF in Sediments

Swimmers and Waders in Lower Trent River							
Receptor	Concentration in Soil/Sediment	Skin Surface Area	Soil Adhesion Factor	Dermal Absorption Factor	Exposure Averaging Factor	Body Weight	Estimated Daily Intake
	pg/g	cm^2	g/cm^2	Unitless	Unitless	kg	pg/kg-day
Child	1279	5140	0.00004	0.03	0.09	32.9	0.021
Teen	1279	8000	0.000019	0.03	0.09	59.7	0.0086
Adult	1279	9110	0.000019	0.03	0.09	70.7	0.0081

4.2.3 Quantifying Total Daily Exposures

Estimates of the daily averaged intakes from each of the individual exposure pathways have been presented in the preceding sections. In order to properly assess the potential hazards and risks associated with exposure to each of the COCs, it is necessary to determine the contribution that each exposure pathway makes to the total daily exposure. The estimated daily exposure from each pathway for PCDD/PCDF for each receptor age group is provided in Table 4-6. This information is used in conjunction with the toxicity data (Section 5) to determine the potential hazards associated with exposure to PCDD/PCDF in sediments in the Lower Trent River and river mouth.

Table 4-6: Estimating Total Daily Exposure to PCDD/PCDF in Sediments

Receptor	Site-Related Daily Intakes		
	Soil Ingestion	Dermal Contact	Combined Site-Related Intakes
	pg/kg-day	pg/kg-day	pg/kg-day
Child	1.2E-01	2.1E-02	1.4E-01
Teen	1.3E-02	8.6E-03	2.1E-02
Adult	1.1E-02	8.1E-03	1.9E-02

[1] A mono-layer is defined as a layer of sediment one particle in thickness that completely covers the identified skin surface area. It should be noted that it is the mono-layer particles that contribute to dermal exposures as PCDD/PCDF bound to particles that are not in direct contact with the skin do not contribute to dermal exposures.

5.0 Toxicity Assessment

5.1 General Information

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) constitute a group of highly persistent, ubiquitous chlorinated organic chemicals (Haws, 2006; WHO, 2000). They have been found to be persistent, bioaccumulative toxicants and have been found in fish, birds and animal tissue as well as in human adipose tissue and milk (Haws, 2006). They are generally unwanted chemicals that have no known industrial use but are by-products of industrial operations and combustion processes, including chlorine bleaching of paper and pulp, production of chlorinated phenols and their derivatives, burning of wastes and fuels and metal smelting (CEPA, 1990; ATSDR, 1998; Haws, 2006). The largest source of PCDDs and PCDFs in Canada is the large-scale burning of municipal and medical waste (Health Canada, 2005).

The effects attributed to PCDDs and PCDFs include dermal toxicity, immunotoxicity, reproductive effects and teratogenicity, endocrine disruption and carcinogenicity (WHO, 2000). Epidemiological studies of PCDD and PCDF exposed workers have not found effects beyond prolonged chloracne (CEPA, 1990).

Structurally related compounds that bind to the aryl hydrocarbon receptor (AhR), the ligand-activated transcription factor, are commonly referred to as dioxin-like compounds (DLCs) or PCDDs and PCDFs. Due to their persistence, tendency to biomagnify through the food chain and lipophilicity, once consumed they accumulate in humans potentially causing chronic lifetime human exposure. Since the mechanism of action is the same and because they are commonly found in the environment as a mixture, the Toxic Equivalency Factor (TEF) methodology has has been developed to assess exposures to PCDD/PCDF mixtures (NTP, 2004abcd).

The TEFs assigned to the various PDCF isomers and congeners are provided in Section 2.5. For the evaluation of PCDDs and PCDFs, it is important to consider the contributions of the entire mixture. However, for the benefit of this report the toxicological profile outlines the physical and chemical properties and toxicological data specifically focusing on TCDD, the most toxic and well-studied of the PCDDs and PCDFs. Where necessary, this document refers to relevant data related to other PCDDs and PCDFs that are essential in the development of appropriate guidelines and limits. For a complete toxicological profile for PCDDs and PCDFs please refer to ATSDR (1998).

5.2 Regulatory Exposure Limits

In deriving a tolerable intake of a particular chemical, regulatory agencies typically rely on both toxicological data from laboratory studies in animals and epidemiological data from exposed human populations to determine the most sensitive adverse effect observed after exposure. The World Health Organization defines a tolerable daily intake (TDI) as:

> *"an estimate of the amount of a substance in food or drinking water, expressed on a body weight basis that can be ingested on a daily basis over a lifetime without appreciable risk" (WHO, 2003).*

A TDI for a particular chemical is generally derived from either a no-observed-adverse-effect-level (NOAEL) or a lowest-observed-adverse-effect level (LOAEL) that has been identified in animal toxicity studies demonstrating the most sensitive effect; i.e., the adverse health effect occurring at the lowest dose of chemical tested. This NOAEL or LOAEL is then adjusted downwards by dividing by uncertainty factors to account for things like inter-species differences (between the test species and humans) and intra-species differences (among individuals within the population). Accordingly, exposure at, or below, the TDI is expected to pose no health risks, even in sensitive people who may be more susceptible. Although TDIs are typically derived from laboratory animal studies, careful consideration is also given to available studies of human exposure (ECSCF, 2001). The sections that follow for PCDD/PCDFs first describe briefly the health effects observed in exposed human populations and then the basis of the various TDIs recommended by regulatory agencies are described.

5.3 Animal Toxicology

Numerous effects have been reported in multiple animal studies following exposure to PCDDs and PCDFs. The most sensitive toxic and biochemical endpoints on a body burden basis are: endometriosis, developmental neurobehavioural (cognitive) effects, developmental reproductive (sperm counts, female urogenital malformations) effects, and adult and developmental immunotoxic effects (WHO, 2000). Of these endpoints, development of the reproductive system in rats was identified by JECFA (2001) to be the most sensitive endpoint in male rat offspring of treated females. The most sensitive reproductive endpoints in male rat offspring were effects on sperm counts and ventral prostate weight (JECFA, 2001). In female rat offspring studies, whose effects included vaginal thread abnormalities; the doses were somewhat higher than those that induced effects in male rat offspring. A wide range of dose-dependent health effects have been documented in laboratory animals exposed to TCDD. The most sensitive indicators of TCDD toxicity appear to be the effects on the developing reproductive systems of male rat fœtuses exposed in utero (COT, 2001). Several studies have reported these effects at various doses but the key study on which the evaluations by JECFA, ECSCF and COT (JECFA, 2001; ECSCF,2001; COT 2001) were based was a study reporting developmental effects in male rats following repeated subcutaneous exposure to the dams (Faqi *et al*., 1998). This study had not been published when WHO conducted its consultation regarding the re-evaluation of the TDI for PCDDs and PCDFs in 1998.

5.4 Human Health Effects

Reported human health effects from exposure to PCDDs and PCDFs are primarily from occupational, epidemiological studies and only a few intentional poisonings. Populations exposed to the highest levels of PCDDs and PCDFs include occupationally exposed workers, for example herbicide producers. Accidentally-exposed populations may be exposed via contamination of the environment or food as was the case for the local population in Seveso, Italy. This population was exposed to substantial quantities of PCDDs and PCDFs in 1976 following a chemical plant explosion (Bertazzi *et al*., 2001). Studies of highly exposed populations suggest various non-cancer health effects are associated with dioxin exposure, for example, chloracne (a skin condition), increases in liver enzymes, increased cardiovascular

disease and developmental effects. However, most of these effects, such as chloracne, appeared only at doses several orders of magnitude greater than the general public receives from background contamination in food (JECFA, 2001). The pattern of exposure in these studies does not reflect long-term dietary exposure (COT, 2001).

5.5 Opinions of Various Regulatory Agencies

TCDD does not affect genetic material and there is a level of exposure below which cancer risk would be negligible (WHO, 1999).

U.S. EPA's reassessment of PCDD and related compounds may place too much confidence in the ability to accurately predict cancer risks at low doses. This approach dramatically increases cancer risk estimates that are not based on compelling new data but rather on the application of statistical models applied to results of occupationally exposed cohorts that have been associated with significant uncertainty regarding actual exposure. This is further confounded by the fact that these models are not yet fully validated and that we still have knowledge gaps with respect to the mechanism of action and interaction for the PCDD and PCDF group of chemicals (ATSDR scientists; Pohl *et al*., 2002).

In the Priority Substance List assessment, Health Canada concluded that there is no adequate demonstration that human populations exposed to PCDDs and PCDFs have suffered excess cancer. However, based on the results of studies in animals, it was assumed that PCDDs and PCDFs are non-genotoxic carcinogens and reproductive toxicants with a threshold, and therefore a tolerable daily intake for human exposure was derived (CEPA, 1997). Officially, the Health Canada and MOE TDI for PCDD/PCDF is 10 pg TEQ/kg-d (MOE, 1985; Health Canada, 2004); however, the WHO/FAO Joint Expert Committee on Food Additives and Contaminants (JECFA) recently proposed a revised Provisional Tolerable Monthly Intake (PTMI) of 70 pg/kg-month (JECFA, 2002). On a daily basis, this PTMI is equivalent to a Provisional Tolerable Daily Intake (PTDI) of 2.3 pg TEQ.kg-d. This revised TDI is being implemented by the federal government and MOE. This TDI is in use by the MOE Sport Fish Advisory Group and will be incorporated into upcoming revisions of MOE's soil and air guidelines. The current model for calculating TEQ is the 1997 WHO TEF scheme for mammals (applies to humans)(van den Berg *et al*., 1998)

Where possible, the TEQ associated with dioxin-like PCBs (DL-PCBs) have been included in the TEQ estimates to ensure that exposure to all dioxin-like compounds are addressed.

6.0 Risk Characterization and Calculation of Site-Specific Intervention Levels

The risk characterization stage of the PQRA process compares the exposures to the contaminants of concern for each of the receptors, with the toxicity reference values to determine if site-related exposures exceed the identified limits. For non-genotoxic chemicals, such as PCDD/PCDFs, the potential for exposures to result in adverse human health effects is based on the ratio between the estimated exposure and the identified toxicity reference value. This ratio is called the *Hazard Quotient* (HQ) and is calculated as shown in Equation 6-1. The HQ provides an indication of whether estimated exposures are large enough to be of concern for human health. A HQ of less than 1.0 indicates that exposures are below the toxicity reference value and would not be expected to result in adverse human health effects. Because of the conservative assumptions used by regulatory agencies in the development of toxicity reference values, HQ values greater than 1.0 do not mean that adverse human health effects will occur, but the likelihood that an adverse effect will occur increases as the HQ value rises above 1.0.

Eq: 6-1:

$$HQ = \frac{EDI_{total}}{TRV}$$

Where:

Parameter	Description	Units
HQ	= Hazard Quotient	unitless
$EDI_{t(r)}$	= Estimated Daily Intake EDI_{total} for receptor r	mg/kg-day
TRV	= Identified toxicological reference value	mg/kg-day

The PRQA for the Lower Trent River and river mouth only considers exposures that result from contact with sediments. Exposures to PCDD/PCDF from other sources such as diet have not been considered. In cases where exposures from all sources are not considered, standard risk assessment practice estimates potential hazards against a hazard acceptability benchmark of 0.2. This ensures that site-related exposures do not exceed twenty percent (20%) of the TRV on a daily basis. This benchmark has been used to assess the potential hazards associated with exposures to PCDD/PCDF in sediments of the Lower Trent River and river mouth. This benchmark has also been used to calculate the SSIL for sediments. Site-specific intervention levels are calculated as shown in Equation 6-2.

Eq 6-2:

$$SSIL = \left(\frac{Benchmark(0.2)}{Site - related\ \_\ HQ} \right) \times TEQ_{\text{insediment}}$$

Where TEQ in soil represents the PCDD/PCDF TEQ concentration in sediment used to estimate exposures.

The HQs calculated for the individual receptors, are provided in Table 6-1. The SSILs calculated for the individual receptors are also provided. The lowest individual SSIL was selected as the final SSIL.

Table 6-1: Hazard Quotients and Site-Specific Intervention Levels for Sediments

Swimmers and Waders in Lower Trent River								
Receptor	Estimated Daily Intake	TRV	HQ	Benchmark	Benchmark/HQ	Concentration in Sediment (pg TEQ/g)	Individual SSILs	Final SSIL
	pg/kg-day	pg/kg-day					pg TEQ/g	pg TEQ/g
Child	1.4E-01	2.3E+00	6.0E-02	2.0E-01	3.4E+00	1.3E+03	4.3E+03	4.3E+03
Teen	2.1E-02	2.3E+00	9.3E-03	2.0E-01	2.2E+01	1.3E+03	2.8E+04	
Adult	1.9E-02	2.3E+00	8.2E-03	2.0E-01	2.4E+01	1.3E+03	3.1E+04	

The HQ values presented for each receptor (HQ column) show that the HQs are below the hazard acceptability benchmark of 0.2. Based on these results, it can be concluded that the maximum reported PCDD/PCDF concentration in sediment, does not represent potential human health hazards. In addition, the SSILs calculated for each of the individual receptor groups are higher than the maximum reported PCDD/PCDF concentrations.

7.0 Discussion of Uncertainties

In preparing the PQRA, a number of assumptions have been used including:

- Assumptions related to time spent in the areas of interest by each of the receptors;
- Assumptions related to PCDD/PCDF concentrations in sediments; and
- Calculation and interpretation of SSILs.

The uncertainties associated with each of these assumptions, and the impacts that they may have on the conclusions of the risk assessment, are briefly discussed below.

7.1 Site-Occupancy Assumptions

The exposure estimates for each of the receptors are based on assumed site-occupancy assumptions. Little guidance is available to indicate typical occupancy times for recreational activities. The occupancy times used in the PQRA are based on best professional judgement and are intended to over-estimate potential exposures. If people spend more time in the areas of interest than has been assumed, exposures will have been underestimated. In this instance, the SSILs would be lower than those presented in the PQRA. However, these changes are likely to be less than an order of magnitude. The SSILs calculated for the individual sites are generally higher than PCDD/PCDF concentrations reported in the various areas of interest. Therefore, changes in the site-occupancy assumptions are unlikely to alter the conclusions of the report.

7.2 PCDD/PCDF Concentrations in Sediments

The PCDD/PCDF concentrations used in the PQRA were limited to the top 20 cm of sediment because it is thought to be unlikely that people engaged in recreational activities would come into contact with sediments below the 20 cm horizon. A review of PCDD/PCDF concentrations from all depths reported by E.C. shows that the maximum reported PCDD/PCDF concentration in these deeper sediments is 2195 pg TEQ/g (see Table B-1 in Appendix B). This value represents the WHO TEQ concentration as calculated from the ITEF TEQ concentration as reported by E.C. (Appendix B). Thus, expanding the sediment horizon to include all sediment samples would not alter the conclusions or the SSIL calculated for the sediments in the Lower Trent River or the river mouth.

7.3 Consideration of Non-Site-Related Exposure Pathways

Non soil-related exposure pathways (ambient air, drinking water, supermarket food) were not considered in the PQRA or in the development of the SSILs. The PQRA and SSILs are based on existing information of sediment-related exposure pathways (direct ingestion and dermal contact with sediment). Other restraints on preliminary assessments include time limitations which preclude the collection of additional information. Using the Brownfields soil criterion development approach means that the SSILs are based on a hazard acceptability benchmark of 0.2 (20% of the TRV).

7.4 Consideration of Sport Fish Consumption

The SSILs developed for the Lower Trent River and river mouth do not include a pathway for local sport fish consumption. Fish consumption has not been included in the PQRA because exposures to PCDD/PCDFs and DL-PCBs for local fish are being managed by the MOE fish consumption advisories, which are updated periodically. Sport fish consumption advice for Lower Trent River and the Bay of Quinte is provided in the Guide to Eating Ontario Sport Fish – 2005-2006 edition. Residents and recreational users of the Lower Trent River and the Bay of Quinte are encouraged to follow these advisories. Updates to the fish consumption advisories can be found on the Ontario Ministry of the Environment website at:
http://www.ene.gov.on.ca/envision/guide/fishadvisory06.pdf.

In addition, there is no precedent for developing SSILs, which include a direct fish consumption pathway, under relevant regulations for Canada (Health Canada, 2004, CCME, 2005), Ontario (Reg. 153) and other major North American agencies (USEPA, 1989 (Superfund) and USEPA, 1996 (Soil Screening Guidance)). Given the complexity of consumption advisories for Bay of Quinte and the lack of methods for including this pathway in the development of SSILs, more information on local sport fish consumption is required.

8.0 Conclusion and Recommendations

8.1 Conclusions

The results of the PQRA indicate that, based upon currently available data, PCDD/PCDF concentrations in sediment in the Lower Trent River and the Bay of Quinte, at the mouth of the Trent River, do not exceed the SSILs calculated for the receptors considered in the assessment. From the results of the PQRA it can be concluded that:

- Investigations of contaminant concentrations in sediments in the Lower Trent River and in the Bay of Quinte, at the mouth of the Trent River, show that the maximum concentration of most contaminants are below the levels that would be allowable in residential soil. Therefore, these contaminants do not pose risks for people using the Lower Trent River or the river mouth area for recreational purposes.
- The maximum concentrations of benzo[*a*]pyrene, lead and mercury exceed the limits that would be considered acceptable in residential soil. In all three cases, concentrations that exceed the residential standards are limited to single samples. For all three contaminants, the maximum reported concentrations are marginally above the residential standards. In all other samples, the concentrations of these three contaminants are below the residential standards. Therefore, exposures to these three contaminants across the study area do not represent a human health concern.
- The risk assessment focused on PCDD/PCDF concentrations in the top 20 cm sediment horizon. PCDD/PCDF concentrations exceeded interim residential standards in 34 of 73 samples taken from the top 20 cm horizon. The risk assessment showed that PCDD/PCDF in sediments (in the top 20 cm horizon) in the Lower Trent River and the Bay of Quinte, at the mouth of the Trent River, do not pose a risk to human health for people who use the area for recreational activities such as boating, swimming or wading.
- The maximum PCDD/PCDF concentration reported in the top 20 cm horizon (1,297 pg TEQ/g) is below the *Site-Specific Intervention Level* (SSIL) of 4,300 pg TEQ/g calculated for the sediments. The SSIL represents the maximum concentration that could be present in the sediments before exposures for the child receptor could exceed the Hazard Acceptability Benchmark of 0.2
- Review of the PCDD/PCDF concentrations in sediment from below the 20 cm horizon were all below the SSIL calculated in the risk assessment. This review also shows that in the deeper sediments, the concentrations of most contaminants are below the residential standards. Minor exceedances of the residential standards are noted in single samples for copper and beryllium. However, as with the metals identified in the surface sediments (0 – 20 cm), these do not represent a potential human health concern.

8.2 Recommendations

Based on the results of the PQRA, the following recommendations can be made:

- Measures to limit human exposures to the sediments in the Lower Trent River and the Bay of Quinte at the mouth of the Trent River are not necessary.

- The results of the PQRA show that exposures to PCDD/PCDF and other contaminants do not pose a potential risk to human health. Given that the PQRA, which is designed to overestimate potential exposures and the associated risks, indicates that human health concerns are not present for the study area, the completion of a detailed human health risk assessment to reduce the level of conservatism in the risk assessment, is not necessary.

- The presence of single samples where the concentrations of benzo[*a*]pyrene, lead and mercury exceeded residential standards, do not represent hot-spots. Additional investigation to delineate these areas is not required to address potential human health concerns.

9.0 Glossary

Bioaccessibility	Refers to the amount of a chemical released from the soil into the fluid in the digestive tract (stomach and intestine). Any chemical that remains bound to the soil is not available for uptake into the body and should not be considered when assessing exposure. Measuring the amount of a chemical released to the stomach and intestine provides a more accurate assessment of exposure.
Bioaccumulative	Substances that increase in concentration in living organisms as they take in contaminated air, water, or food because the substances are very slowly metabolized or excreted (USEPA, 2006).
Carcinogen	Any substance that can cause cancer.
Carcinogenic	The ability of a substance to cause cancer.
Carrier	The inert liquid or solid material in a pesticide product that serves as a delivery vehicle for the active ingredient. Carriers do not have toxic properties of their own (USEPA, 2006).
COCs	**Chemicals of Concern.** Chemicals that are present at concentrations that exceed their respective guideline concentration are identified as chemicals of concern and are carried through to a quantitative risk assessment to determine if the chemical poses a risk to humans or the environment.
CSM	Identifies the potentially complete and incomplete exposure pathways for any given site.
Congener	One of many variants or configurations of a common chemical structure (Green Facts, 2006). For example 2,3,7,8-tetrachlorodibenzo-p-dioxin and 2,3,4,6,7,8-pentrachlorodibenzo-p-dioxin are both dioxins, but they differ in the number of chlorine atoms that are attached to the dioxin molecule.
CSF	**Cancer Slope Factor.** Usually expressed as $(\mu g/kg\text{-}day)^{-1}$, which represents the potential risk of developing cancer per microgram of chemical per kilogram body weight per day. The cancer slope factor is a measure of the carcinogenic potency of a chemical that is known, or is suspected to be, carcinogenic.
Dermal Permeability Coefficient	Indicates the rate at which a chemical substance permeates through the skin (Intota, 2006).
Dermal Toxicity	The ability of a pesticide or chemical to poison people or animals by contact with the skin (USEPA, 2006).
Diluent	Any liquid or solid material used to dilute or carry an active ingredient (USEPA, 2006).

EDI	**Estimated Daily Intake.** Usually expressed as μg/kg-day (micrograms of chemical per kilogram body weight per day). This is a measure of the daily exposure to a chemical experienced by a receptor. The EDI values are used directly, to assess the potential hazards associated with exposures to non-carcinogenic chemicals. The EDI is used in the calculation of the life-time averaged daily dose (LADD) when assessing the potential risks associated with exposures to carcinogenic chemicals.
Endocrine	System of the human body that releases hormones into the blood stream or lymph system. These hormones control growth, metabolism, mood, and reproduction and influence almost every cell and organ in our body (EcoHealth, 2006).
Epidemiology	The study of distribution of disease, or events, in human populations in order to identify and alleviate health problems and to promote better health (USEPA, 2006).
Exposure Duration	The total time period over which contacts occur between a receptor and site of interest. For, example, if an individual is present at the site 8 hours a day, for 250 days over a one-year time period, the exposure duration is one year.
Exposure Frequency	The number of exposure intervals in an exposure duration. For example, if an individual is present at the site 8 hours per day, for 250 days over a one-year time period, the exposure frequency is 250 days per year.
Exposure Pathway	An exposure pathway describes how a chemical can move from an environmental medium (soil, water, air) to come into contact with the body. For example the movement of chemical from soil into backyard garden vegetables and the consumption of these vegetables by people is an exposure pathway that contributes to ingestion exposure.
Exposure Route	An exposure route describes how a chemical may enter the body. There are three main routes by which chemical can enter the body: ingestion, inhalation and dermal contact (uptake through the skin).
Gastrointestinal Absorption Factor	The fraction of a chemical absorbed by the gastrointestinal tract when a substance is ingested.
Genotoxic	A substance that is known to damage DNA.
Herbicide	A chemical pesticide designed to control or destroy plants, weeds, or grasses (USEPA, 2006).
HI	**Hazard Index.** This is a comparison of the estimated exposure to a non-carcinogenic chemical and the toxicity value for the chemical. HI values less than one mean that the exposures are below the threshold where adverse effects may be expected to occur. HI values greater than one mean that the estimated exposures exceed the established toxicity value. In this case, the potential for an adverse health effect to occur increases as the HI value increase above 1.

Immunotoxicity	Any adverse effect on an organism's immune system that results from exposure to a chemical substance (PA, 2006).
Isomers	One of two or more compounds composed of the same percentage of elements but differing in structure and properties (SPBG, 2006), For example, 2,3,7,8-tetrachlorodibenzo-p-dioxin and 2,3,6,7-tetrachlorodibenzo-p-dioxin both have 4 chlorine atoms attached to the dioxin molecule, but the chlorines are attached at different locations on the dioxin molecules.
LADD	**Life-time averaged daily dose.** Usually expressed as μg/kg-day (micrograms of chemical per kilogram body weight per day). This is used to estimate the effective daily exposure to carcinogenic chemicals. This represents the daily exposure that a person would experience over a life-time. If exposures occur every day over a life-time, the LADD would be equal to the daily dose. If exposures occur only for a portion of a life-time the LADD averages the exposure over a full life-time and the LADD will be lower than the daily intake value that is estimated while exposures are occurring.
LOAEL	**Lowest Observed Adverse Effect Level.** The lowest level of a stressor that causes statistically and biologically significant differences in test samples as compared to other samples subjected to no stressor (USEPA, 2006).
NOAEL	**No Observable Adverse Effect Level.** An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered as adverse, or as precursors to adverse effects. In an experiment with several NOAELs, the regulatory focus is primarily on the highest one, leading to the common usage of the term NOAEL as the highest exposure without adverse effects (USEPA, 2006).
Non-carcinogen	A chemical that has not been shown to cause cancer in animals or humans.
Organochlorine Compound	A chemical substance that contains carbon and chlorine atoms. This term is most often used to describe pesticides that contain chlorine atoms, such as heptachlor or DDT.
Pesticide	Substances or mixtures that are intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant (USEPA, 2006).
Receptor	A receptor is defined as a person or animal that may come into contact with a chemical.

R*f*D	**Reference Dose.** Usually expressed as µg/kg-day (micrograms of chemical per kilogram body weight per day). The R*f*D is a quantitative estimate (with uncertainty spanning perhaps an order of magnitude (ten-fold)) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of non-carcinogenic deleterious effects during a life-time.
Screening Value	Guideline concentrations for individual chemicals usually from governmental agencies that are used to compare to concentrations found on a site of interest to determine Chemicals of Concern for a Risk Assessment.
Teratogen	A substance capable of causing birth defects (USEPA, 2006).
TEF	**Toxic Equivalency Factor.** The TEF is a measure of the potency of a chemical relative to another carcinogenic chemical. TEF values are only developed for chemicals that act in the same way in the body and produce the same effect. For this assessment, the TEF is a measure of the potencies of the PCDD and PDCF congeners relative to 2,3,7,8-tetrachorodibenzo-p-dioxin (2,3,7,8-TCDD).
TEQ	**Toxic Equivalency.** The TEQ is a measure of the total potency of a mixture of chemicals that act in the same way in the body. For example, PCDD/PCDF isomers and congeners produce the same biological reactions in the body and in the same way. The difference between them is the amount of each PCDD/PCDF required to produce the same biological effect. Because all of the PCDD/PCDF produces the same effects, the combined exposure can be considered as a larger dose of 2,3,7,8-TCDD. The TEQ can be considered as a measure of this increased dose of 2,3,7,8-TCDD.
Threshold	The threshold represents a level of exposure for non-carcinogenic chemicals below which no adverse health effects would be expected to occur. When non-carcinogenic chemicals are present in the body at concentrations that are lower than the threshold, the body is able to process and remove the chemical without the chemical causing any adverse health effects. When exposures are greater than the threshold, the level of the chemical in the body increases faster than the body can process and remove it. In this case, the chemical has the potential to cause adverse health effects.
Toxicity Reference Value (TRV)	The toxicity reference value is a measure of the potency of a chemical (see RfD (Reference Dose).

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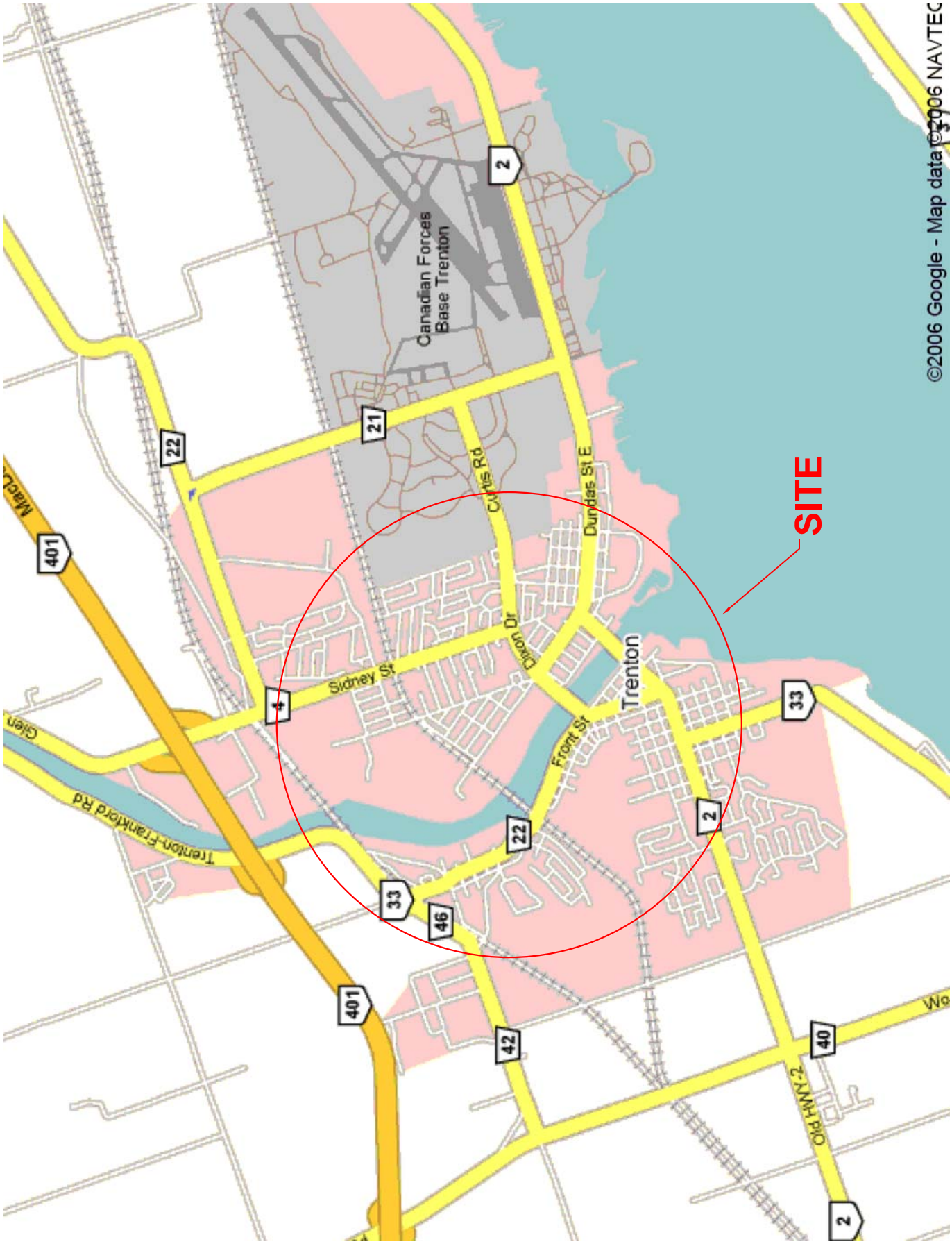
FIGURES



DILLON CONSULTING	**SITE LOCATION MAP**	PROJECT NO. **06-5735**
DATE **MAY 2006**	**LOWER TRENT RIVER, TRENTON, ONTARIO**	FIGURE NO. **1**

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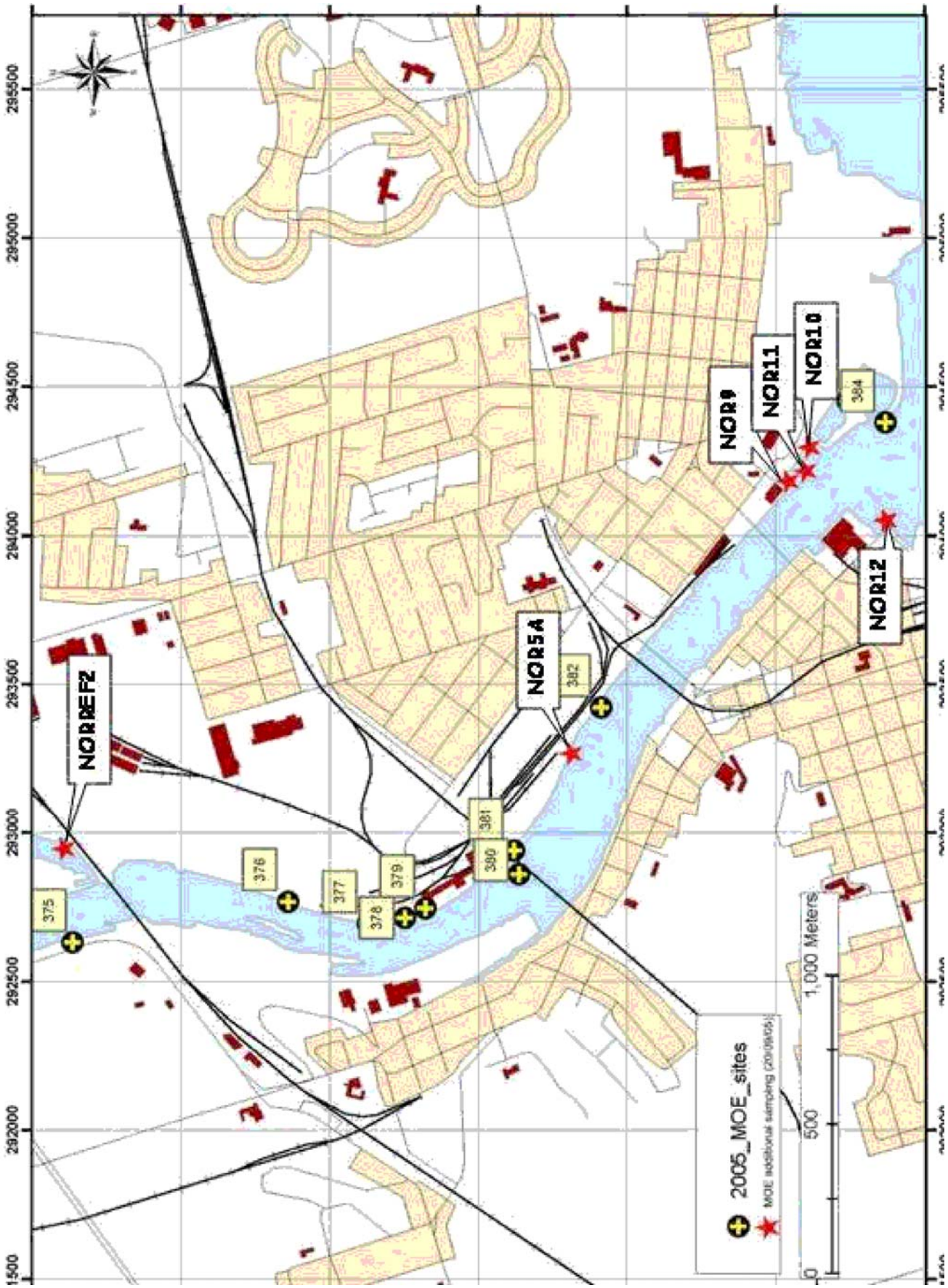

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DATE **MAY 2006**

MOE SAMPLING LOCATIONS - 2005

LOWER TRENT RIVER, TRENTON, ONTARIO

PROJECT NO. **06-5735**

FIGURE NO. **2**

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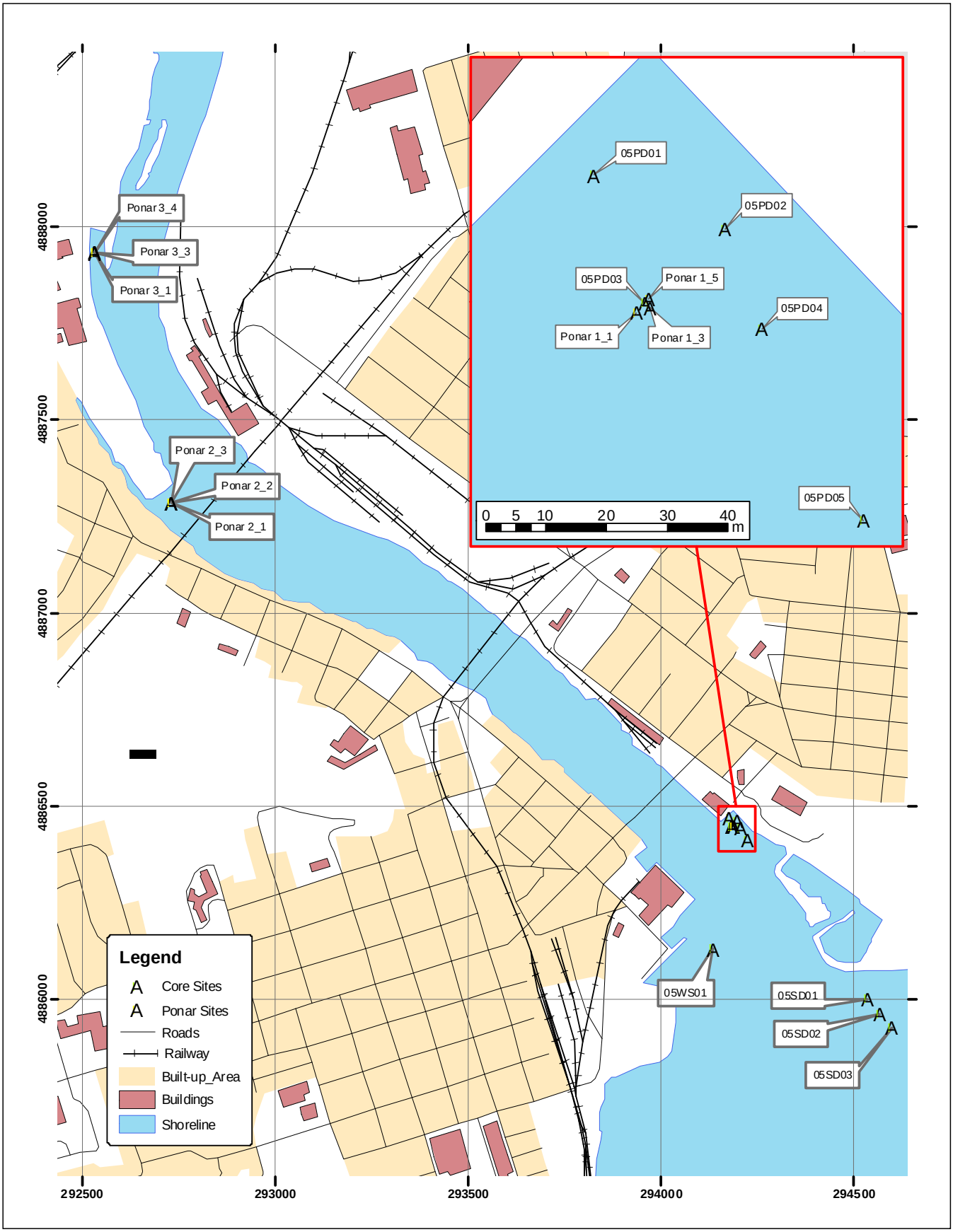

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DATE May 2006

EC SAMPLING LOCATIONS

LOWER TRENT RIVER, TRENTON, ONTARIO

PROJECT NO. **06-5735**

FIGURE NO. **3**

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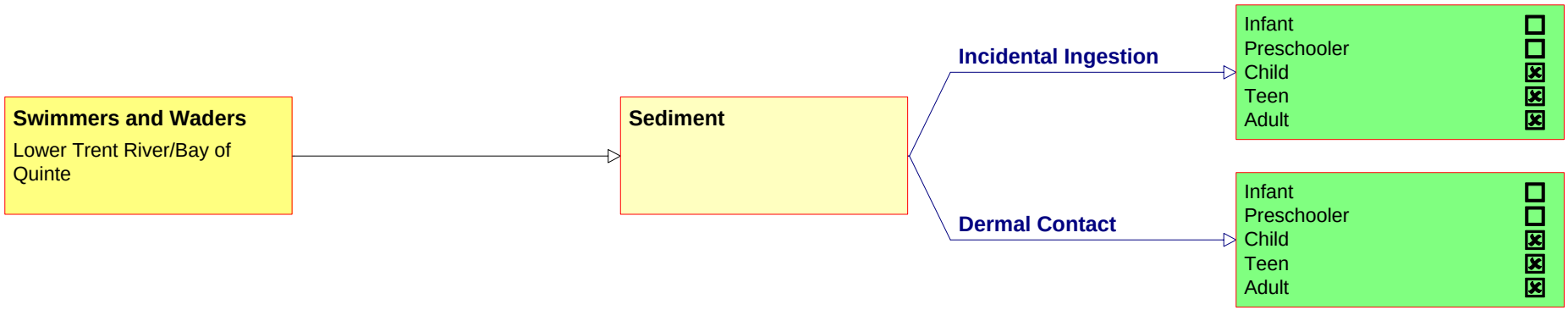

Line Styles

Significant Pathway

Insignificant Pathway

Negligible Pathway

APPENDIX A
Environmental Quality Data for Sediments (0-20 cm) and Surface Water

Appendix A

List of Tables

Table A1 - Lower Trent River
Metals Analyses in Groundwater

Metal	Ontario Ministry of the Environment Sample Locations											
	NORAMREF	NORAM 1	NORAM 2	NORAM 3	NORAM 4	NORAM 5	NORAM 6	NORAM 7	NORAM 8	NORAM 9	NORREF2	NOR5A
Arsenic	0.5	5	4.5	13	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1
Selenium	0.5	5	0.5	4.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Aluminum	10	26.5	4090	1560	30.3	17.5	29.2	18.8	23.3	13.8	17.8	6.85
Barium	37	37.2	115	301	37.4	37.1	36.9	50.5	38.9	37.1	45.1	107
Beryllium	0.00469		0.142	0.0889	0.00469	0.00473	0.00304	0.0142	0.00127	0.00129		
Cadmium	0.252		0.557	0.595	0.1				0.00476	0.329	0.0681	0.017
Cobalt	0.45	0.756	2.34	2.03		0.272	0.348	0.17				0.96
Chromium	0.26	0.171	8.94	4.57	0.311	0.49		0.796	0.273	0.184		
Copper	0.375	0.561	10.6	10.5	0.561	0.635	0.684	0.598	2.24	0.104	0.875	3.6
Iron	28.9	29.3	4430	3170	41.9	34.2	39.1	46.2	198	33.8	47.2	341
Manganese	15.4	15.2	313	**769**	15.8	15.3	15.3	77.4	15	20.8	18.5	107
Molybednum			3.67	3.2								0.231
Nickel	0.0716	0.276	5.32	5.94			0.242					1.27
Lead				5.69				1.56	2.95		0.392	0.131
Strontium	118	119	232	632	119	119	118	215	109	119	138	425
Titanium			218	72.3	0.209	0.185	0.299		0.613	0.118	0.946	1.36
Vanadium	1.11	0.367	18.6	4.25	0.885	1.05	0.691		0.432	1.14		0.101
Zinc	1.51	0.0612	61.5	55	0.575	0.763	0.67	1.95	2.87	0.575	0.0011	31.5

MOE (2004) Table 2 Criteria for Potable Ground Water, All Types of Property Use.
USEPA (2005) Region III Risk-Based Concentration Tables for Tap Water

Table A1 - Lower Trent River
Metals Analyses in Groundwater

rio Ministry of the Environment Sample Loca				Maximum Concentration (µg/L)	95th Percentile Concentration	Screening Standards	
NOR9	NOR10	NOR11	NOR12			(µg/L)	Source
0.5	0.5	0.5	0.5	13		25	MOE 2004
0.5	0.5	0.5	0.5	5		10	MOE 2004
14.6	13.3	19.2	15.5	4090		37000	USEPA, 2005
45.7	45.4	45	45.5	301		1000	MOE 2004
		0.00989		0.142		4	MOE 2004
0.255	0.051	0.221	0.408	0.595		5	MOE 2004
0.523	0.401	0.109	0.207	2.34		100	MOE 2004
				8.94		50	MOE 2004
0.791	0.633	0.959	0.205	10.6		23	MOE 2004
48.9	64.8	47.8	67.8	4430		11000	USEPA, 2005
20.7	25.9	19.8	21.1	**769**	427	730	USEPA, 2005
			0.231	3.67		7300	MOE 2004
		0.866		5.94		100	MOE 2004
	4.97	3.47		5.69		10	MOE 2004
140	138	137	138	632		22000	USEPA, 2005
0.777	0.823	0.865	0.628	218		150000	USEPA, 2005
0.27	0.253			18.6		200	MOE 2004
0.259	0.364		0.203	61.5		1100	MOE 2004

Table A2 - Lower Trent River
Conversion of ITEF TEQs to WHO TEQs, Sediment (<20 cm) Data

	Sample Location		TR - 01						TR-02					
	Sample Date		5/5/2005						5/5/2005					
	Sample Depth		0-5 cm		5 -10 cm		10-20 cm		0-5 cm		5 -10 cm		10-20 cm	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	2.08	2.08	4.49	4.49	1.93	1.93	1.69	1.69	2.64	2.64	1.87	1.87
1,2,3,7,8-PnCDD	0.5	1	6.11	12.22	18.39	36.78	17.57	35.14	5.21	10.42	13.18	26.36	22.89	45.78
1,2,3,4,7,8-HxCDD	0.1	0.1	10.29	10.29	52.24	52.24	112.14	112.14	2.00	2.00	85.05	85.05	237.60	237.60
1,2,3,6,7,8-HxCDD	0.1	0.1	13.06	13.06	52.02	52.02	51.81	51.81	6.83	6.83	39.33	39.33	64.00	64.00
1,2,3,7,8,9-HxCDD	0.1	0.1	6.63	6.63	18.06	18.06	20.75	20.75	3.60	3.60	17.85	17.85	24.09	24.09
1,2,3,4,6,7,8-HpCDD	0.01	0.01	76.51	76.51	333.17	333.17	368.04	368.04	59.80	59.80	322.52	322.52	441.36	441.36
OCDD	0.001	0.0001	53.91	5.39	216.83	21.68	222.46	22.25	75.55	7.56	154.03	15.40	211.07	21.11
2,3,7,8-TCDF	0.1	0.1	2.15	2.15	2.60	2.60	2.03	2.03	2.08	2.08	2.52	2.52	2.89	2.89
1,2,3,7,8-PnCDF	0.05	0.05	0.32	0.32	0.87	0.87	0.55	0.55	0.35	0.35	0.53	0.53	0.73	0.73
2,3,4,7,8-PnCDF	0.5	0.5	3.30	3.30	5.91	5.91	2.25	2.25	1.53	1.53	3.09	3.09	5.37	5.37
1,2,3,4,7,8-HxCDF	0.1	0.1	2.05	2.05	4.68	4.68	5.12	5.12	1.18	1.18	4.40	4.40	7.48	7.48
1,2,3,6,7,8-HxCDF	0.1	0.1	1.14	1.14	3.08	3.08	4.21	4.21	0.47	0.47	4.67	4.67	8.19	8.19
1,2,3,7,8,9-HxCDF	0.1	0.1	1.49	1.49	3.25	3.25	3.28	3.28	0.70	0.70	2.25	2.25	3.00	3.00
2,3,4,6,7,8-HxCDF	0.1	0.1	N.C.		0.64	0.64	0.64	0.64	N.C.		0.51	0.51	0.71	0.71
1,2,3,4,6,7,8-HpCDF	0.01	0.01	3.84	3.84	12.41	12.41	16.92	16.92	5.57	5.57	14.37	14.37	21.65	21.65
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.33	0.33	0.87	0.87	1.50	1.50	0.24	0.24	1.08	1.08	1.84	1.84
OCDF	0.001	0.0001	1.87	0.19	5.58	0.56	7.69	0.77	3.39	0.34	4.97	0.50	7.29	0.73
PCB081- 3,4,4',5-tetrachlorobiphenyl		0.0001	0.02238	0.00000	0.03379	0.00000	0.02190	0.00000						
PCB077 - 3,3',4,4'-tetrachlorobiphenyl		0.0001	0.86440	0.00009	1.48792	0.00015	1.24093	0.00012						
PCB123 - 2'3,4,4',5-pentachlorobiphenyl		0.0001	0.96429	0.00010	1.09538	0.00011	0.76996	0.00008						
PCB118 - 2,3'4,4',5-pentachlorobiphenyl		0.0001	7.00548	0.00070	5.85873	0.00059	4.71199	0.00047						
PCB114 - 2,3,4,4',5-pentachlorobiphenyl		0.0005	0.20040	0.00010	0.18449	0.00009	0.12306	0.00006						
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl		0.0001	2.97939	0.00030	2.57139	0.00026	1.83305	0.00018						
PCB126 - 3,3'4,4',5-pentachlorobiphenyl		0.1	0.03776	0.00378	0.04625	0.00463	0.03060	0.00306						
PCB167 - 23',44',55'-hexachlorobiphenyl		0.00001	0.31269	0.00000	0.25453	0.00000	0.16210	0.00000						
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl		0.0005	0.78457	0.00039	0.62599	0.00031	0.39880	0.00020						
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl		0.0005	0.17192	0.00009	0.14176	0.00007	0.08451	0.00004						
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl		0.01	0.00691	0.00007	0.01090	0.00011	0.00390	0.00004						
PCB189 - 233'44'55'-heptachlorobiphenyl		0.0001	0.04178	0.00000	0.04467	0.00000	0.03486	0.00000						
Total TEQ				140.99		553.32		649.33		104.35		543.07		888.40

Table A2 - Lower Trent River
Conversion of ITEF TEQs to WHO TEQs, Sediment (<20 cm) Data

	Sample Location		TR-03						TR-07					
	Sample Date		5/5/2005						5/5/2005					
	Sample Depth		0-5 cm		5 -10 cm		10-20 cm		0-5 cm		5 -10 cm		10-20 cm	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	0.84	0.84	0.56	0.56	N.C.		N.C.		1.59	1.59	4.13	4.13
1,2,3,7,8-PnCDD	0.5	1	3.09	6.18	3.33	6.66	3.80	7.60	5.81	11.62	8.84	17.68	5.57	11.14
1,2,3,4,7,8-HxCDD	0.1	0.1	3.53	3.53	4.19	4.19	2.18	2.18	9.23	9.23	19.47	19.47	27.35	27.35
1,2,3,6,7,8-HxCDD	0.1	0.1	20.07	20.07	10.35	10.35	3.11	3.11	12.77	12.77	20.37	20.37	37.48	37.48
1,2,3,7,8,9-HxCDD	0.1	0.1	4.99	4.99	5.02	5.02	0.95	0.95	3.73	3.73	7.93	7.93	16.68	16.68
1,2,3,4,6,7,8-HpCDD	0.01	0.01	280.19	280.19	86.19	86.19	24.49	24.49	96.33	96.33	201.83	201.83	272.95	272.95
OCDD	0.001	0.0001	143.61	14.36	57.16	5.72	18.80	1.88	64.85	6.49	178.16	17.82	238.31	23.83
2,3,7,8-TCDF	0.1	0.1	1.52	1.52	0.79	0.79	0.34	0.34	1.67	1.67	2.09	2.09	11.85	11.85
1,2,3,7,8-PnCDF	0.05	0.05	0.15	0.15	0.20	0.20	N.C.		N.C.		0.39	0.39	1.75	1.75
2,3,4,7,8-PnCDF	0.5	0.5	2.20	2.20	1.66	1.66	N.C.		0.99	0.99	4.66	4.66	16.48	16.48
1,2,3,4,7,8-HxCDF	0.1	0.1	1.95	1.95	1.29	1.29	0.63	0.63	1.02	1.02	3.70	3.70	24.99	24.99
1,2,3,6,7,8-HxCDF	0.1	0.1	0.62	0.62	1.01	1.01	0.47	0.47	1.40	1.40	4.17	4.17	10.39	10.39
1,2,3,7,8,9-HxCDF	0.1	0.1	0.71	0.71	0.86	0.86	0.54	0.54	1.36	1.36	2.74	2.74	10.77	10.77
2,3,4,6,7,8-HxCDF	0.1	0.1	N.C.		0.12	0.12	N.C.		N.C.		0.28	0.28	N.C.	
1,2,3,4,6,7,8-HpCDF	0.01	0.01	7.83	7.83	3.85	3.85	1.26	1.26	4.10	4.10	12.28	12.28	23.49	23.49
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.50	0.50	0.27	0.27	0.11	0.11	0.15	0.15	0.95	0.95	1.12	1.12
OCDF	0.001	0.0001	4.90	0.49	2.20	0.22	0.65	0.07	2.02	0.20	5.54	0.55	9.84	0.98
PCB081- 3,4,4',5-tetrachlorobiphenyl		0.0001							0.01717	1.717E-06	0.03858	3.858E-06	0.20057	2.006E-05
PCB077 - 3,3',4,4'-tetrachlorobiphenyl		0.0001							0.74212	7.421E-05	2.03244	0.0002032	9.52655	0.0009527
PCB123 - 2'3,4,4',5-pentachlorobiphenyl		0.0001							0.53088	5.309E-05	1.41118	0.0001411	4.95026	0.000495
PCB118 - 2,3'4,4',5-pentachlorobiphenyl		0.0001							3.03758	0.0003038	8.17405	0.0008174	29.48648	0.0029486
PCB114 - 2,3,4,4',5-pentachlorobiphenyl		0.0005							0.08347	4.174E-05	0.21573	0.0001079	1.00196	0.000501
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl		0.0001							1.46498	0.0001465	3.2824	0.0003282	12.42804	0.0012428
PCB126 - 3,3'4,4',5-pentachlorobiphenyl		0.1							0.03018	0.003018	0.05142	0.005142	0.18638	0.018638
PCB167 - 23',44',55'-hexachlorobiphenyl		0.00001							0.14437	1.444E-06	0.27477	2.748E-06	0.58067	5.807E-06
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl		0.0005							0.34447	0.0001722	0.69895	0.0003495	1.53725	0.0007686
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl		0.0005							0.07764	3.882E-05	0.15649	7.825E-05	0.37228	0.0001861
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl		0.01							0.00608	0.0000608	0.01072	0.0001072	0.02407	0.0002407
PCB189 - 233'44'55'-heptachlorobiphenyl		0.0001							0.02748	2.748E-06	0.04773	4.773E-06	0.10758	1.076E-05
Total TEQ				346.13		128.96		43.63		151.06		318.51		495.41

Table A2 - Lower Trent River
Conversion of ITEF TEQs to WHO TEQs, Sediment (<20 cm) Data

	Sample Location		TR-12					
	Sample Date		5/5/2005					
	Sample Depth		0-5 cm		5 -10 cm		10-20 cm	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	N.C.		2.55	2.55	1.24	1.24
1,2,3,7,8-PnCDD	0.5	1	N.C.		10.42	20.84	3.57	7.14
1,2,3,4,7,8-HxCDD	0.1	0.1	N.C.		4.58	4.58	9.06	9.06
1,2,3,6,7,8-HxCDD	0.1	0.1	66.97	66.97	29.92	29.92	13.82	13.82
1,2,3,7,8,9-HxCDD	0.1	0.1	21.25	21.25	6.76	6.76	5.37	5.37
1,2,3,4,6,7,8-HpCDD	0.01	0.01	1043.10	1043.10	302.40	302.40	115.87	115.87
OCDD	0.001	0.0001	854.54	85.45	150.08	15.01	111.70	11.17
2,3,7,8-TCDF	0.1	0.1	3.16	3.16	0.87	0.87	1.09	1.09
1,2,3,7,8-PnCDF	0.05	0.05	N.C.		0.33	0.33	0.50	0.50
2,3,4,7,8-PnCDF	0.5	0.5	7.70	7.70	2.02	2.02	2.41	2.41
1,2,3,4,7,8-HxCDF	0.1	0.1	5.78	5.78	2.21	2.21	2.61	2.61
1,2,3,6,7,8-HxCDF	0.1	0.1	N.C.		1.19	1.19	1.98	1.98
1,2,3,7,8,9-HxCDF	0.1	0.1	N.C.		0.66	0.66	0.77	0.77
2,3,4,6,7,8-HxCDF	0.1	0.1	N.C.		0.17	0.17	N.C.	
1,2,3,4,6,7,8-HpCDF	0.01	0.01	42.89	42.89	7.68	7.68	8.42	8.42
1,2,3,4,7,8,9-HpCDF	0.01	0.01	N.C.		0.87	0.87	0.50	0.50
OCDF	0.001	0.0001	23.60	2.36	3.52	0.35	4.60	0.46
PCB081- 3,4,4',5-tetrachlorobiphenyl		0.0001	0.05204	5.204E-06	0.01424	1.424E-06	0.04434	4.434E-06
PCB077 - 3,3',4,4'-tetrachlorobiphenyl		0.0001	2.58188	0.0002582	0.63849	6.385E-05	1.99298	0.0001993
PCB123 - 2'3,4,4',5-pentachlorobiphenyl		0.0001	1.68244	0.0001682	0.45621	4.562E-05	1.12951	0.000113
PCB118 - 2,3'4,4',5-pentachlorobiphenyl		0.0001	10.87514	0.0010875	2.72058	0.0002721	7.93297	0.0007933
PCB114 - 2,3,4,4',5-pentachlorobiphenyl		0.0005	0.30629	0.0001531	0.08146	4.073E-05	0.20761	0.0001038
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl		0.0001	4.80585	0.0004806	1.23781	0.0001238	3.18753	0.0003188
PCB126 - 3,3'4,4',5-pentachlorobiphenyl		0.1	0.07106	0.007106	0.02018	0.002018	0.04156	0.004156
PCB167 - 23',44',55'-hexachlorobiphenyl		0.00001	0.36237	3.624E-06	0.11618	1.162E-06	0.26813	2.681E-06
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl		0.0005	0.93347	0.0004667	0.30185	0.0001509	0.68213	0.0003411
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl		0.0005	0.21813	0.0001091	0.06285	3.143E-05	0.14417	7.209E-05
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl		0.01	0.01205	0.0001205	0.00239	0.0000239	0.00832	0.0000832
PCB189 - 233'44'55'-heptachlorobiphenyl		0.0001	0.06332	6.332E-06	0.02001	2.001E-06	0.04447	4.447E-06
Total TEQ				1278.67		398.41		182.42

Table A2 - Lower Trent River
Conversion of ITEF TEQs to WHO TEQs, Sediment (<20 cm) Data

	Sample Location		TR-13								Maximum TEQ
	Sample Date		5/5/2005								
	Sample Depth		0-5 cm		5 -10 cm		5 -10 cm		10-20 cm		
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	
2,3,7,8-TCDD	1	1	1.40	1.40	1.71	1.71	1.73	1.73	N.C.		
1,2,3,7,8-PnCDD	0.5	1	2.70	5.40	2.90	5.80	3.74	7.48	N.C.		
1,2,3,4,7,8-HxCDD	0.1	0.1	4.23	4.23	16.41	16.41	20.76	20.76	1.00	1.00	
1,2,3,6,7,8-HxCDD	0.1	0.1	17.23	17.23	15.03	15.03	24.75	24.75	1.55	1.55	
1,2,3,7,8,9-HxCDD	0.1	0.1	7.63	7.63	7.25	7.25	10.68	10.68	0.30	0.30	
1,2,3,4,6,7,8-HpCDD	0.01	0.01	70.13	70.13	110.19	110.19	152.04	152.04	11.14	11.14	
OCDD	0.001	0.0001	35.30	3.53	62.44	6.24	85.74	8.57	8.21	0.82	
2,3,7,8-TCDF	0.1	0.1	0.76	0.76	1.17	1.17	1.20	1.20	0.27	0.27	
1,2,3,7,8-PnCDF	0.05	0.05	0.14	0.14	0.16	0.16	0.22	0.22	0.07	0.07	
2,3,4,7,8-PnCDF	0.5	0.5	1.43	1.43	1.77	1.77	1.90	1.90	0.93	0.93	
1,2,3,4,7,8-HxCDF	0.1	0.1	0.76	0.76	1.71	1.71	2.19	2.19	0.44	0.44	
1,2,3,6,7,8-HxCDF	0.1	0.1	0.55	0.55	1.47	1.47	1.59	1.59	0.30	0.30	
1,2,3,7,8,9-HxCDF	0.1	0.1	0.47	0.47	0.74	0.74	0.93	0.93	0.29	0.29	
2,3,4,6,7,8-HxCDF	0.1	0.1	N.C.		0.26	0.26	0.13	0.13	N.C.		
1,2,3,4,6,7,8-HpCDF	0.01	0.01	2.91	2.91	5.36	5.36	9.44	9.44	1.03	1.03	
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.25	0.25	0.38	0.38	0.66	0.66	0.07	0.07	
OCDF	0.001	0.0001	1.47	0.15	2.81	0.28	5.16	0.52	0.35	0.04	
PCB081- 3,4,4',5-tetrachlorobiphenyl		0.0001									
PCB077 - 3,3',4,4'-tetrachlorobiphenyl		0.0001									
PCB123 - 2'3,4,4',5-pentachlorobiphenyl		0.0001									
PCB118 - 2,3'4,4',5-pentachlorobiphenyl		0.0001									
PCB114 - 2,3,4,4',5-pentachlorobiphenyl		0.0005									
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl		0.0001									
PCB126 - 3,3'4,4',5-pentachlorobiphenyl		0.1									
PCB167 - 23',44',55'-hexachlorobiphenyl		0.00001									
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl		0.0005									
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl		0.0005									
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl		0.01									
PCB189 - 233'44'55'-heptachlorobiphenyl		0.0001									
Total TEQ				116.97		175.94		244.79		18.25	1278.67

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		EC 2006				EC 2006		EC 2006		EC 2006		EC 2006		EC 2006	
		05TRSED-11				05TRSED-27		05TRSED-25		05TRSED-38		05TRSED-36		05TRSED-15	
		05PD01		Duplicate		05PD01		05PD01		05PD02		05PD02		05PD02	
		0 - 5 cm		0 - 5 cm		5 - 10 cm		10 - 20 cm		0 - 5 cm		5 -10 cm		10 - 20 cm	
PCDD Congeners	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	0.67	0.67	0.62	0.62	3.13	3.13	0.8	0.8	2.5	2.5	2.75	2.75	1.1	1.1
1,2,3,7,8-PnCDD	1	5.88	5.88	5.92	5.92	9.51	9.51	10	10	10.1	10.1	12.9	12.9	3.8	3.8
1,2,3,4,7,8-HxCDD	0.1	7.23	0.723	4.5	0.45	13.68	1.368	15.7	1.57	19.9	1.99	31.6	3.16	11.8	1.18
1,2,3,6,7,8-HxCDD	0.1	28.74	2.874	25.16	2.516	36.9	3.69	64.8	6.48	82.7	8.27	189.1	18.91	64.7	6.47
1,2,3,7,8,9-HxCDD	0.1	16.54	1.654	11.55	1.155	21.78	2.178	27.5	2.75	31.6	3.16	49.5	4.95	28.1	2.81
1,2,3,4,6,7,8-HpCDD	0.01	855.53	8.5553	872.62	8.7262	990.48	9.9048	1881.4	18.814	3143.8	31.438	6216.8	62.168	2343.6	23.436
OCDD	0.0001	7293.04	0.729304	7160.91	0.716091	8402.07	0.840207	16797.4	1.67974	30957.4	3.09574	66251.8	6.62518	24440.4	2.44404
2,3,7,8-TCDF	0.1	10.88	1.088	11.06	1.106	18.05	1.805	12.4	1.24	15.2	1.52	10.2	1.02	8.1	0.81
1,2,3,7,8-PnCDF	0.05	2.32	0.116	2.62	0.131	6.45	0.3225	4.5	0.225	8.2	0.41	6.2	0.31	4.7	0.235
2,3,4,7,8-PnCDF	0.5	3.12	1.56	2.67	1.335	7.42	3.71	1.9	0.95	4	2	6.2	3.1	2.7	1.35
1,2,3,4,7,8-HxCDF	0.1	5.42	0.542	5.4	0.54	12.51	1.251	14.7	1.47	16.9	1.69	27.6	2.76	8	0.8
1,2,3,6,7,8-HxCDF	0.1	4.61	0.461	3.8	0.38	10.33	1.033	12.4	1.24	16.4	1.64	37.8	3.78	15.6	1.56
1,2,3,7,8,9-HxCDF	0.1	0.795	0.0795	0.795	0.0795	3.96	0.396	3.5	0.35	4.6	0.46	6.7	0.67	3.6	0.36
2,3,4,6,7,8-HxCDF	0.1	3.54	0.354	2.15	0.215	8.5	0.85	9.1	0.91	13.5	1.35	49	4.9	12.9	1.29
1,2,3,4,6,7,8-HpCDF	0.01	153.6	1.536	149.08	1.4908	234.44	2.3444	293.2	2.932	450	4.5	1001.9	10.019	425.4	4.254
1,2,3,4,7,8,9-HpCDF	0.01	11.17	0.1117	10.83	0.1083	17.81	0.1781	28.6	0.286	34.9	0.349	72.8	0.728	31.4	0.314
OCDF	0.0001	762.76	0.076276	785.2	0.07852	952.58	0.095258	1369.3	0.13693	2141.6	0.21416	4542.6	0.45426	2087.8	0.20878
PCDD/PCDF TEQ (1/2 ND)			27.01008		25.56741		42.60627		51.83367		74.6869		139.2044		52.42182
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001														
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001														
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001														
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001														
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005														
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001														
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1														
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001														
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005														
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005														
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01														
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001														
PCB TEQ (1/2 ND)															
Total TEQ			27.01		25.57		85.21		51.83		74.69		139.20		52.42

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		EC 2006		EC 2006				EC 2006		EC 2006		EC 2006		EC 2006	
		05TRSED-02		**05TRSED-31**				**05TRSED-46**		**05TRSED-20**		**05TRSED-39**		**05TRSED-55**	
		05PD02		**05PD02**		**Duplicate**		**05PD03**		**05PD03**		**05PD03**		**05PD04**	
		10 - 20 cm		**10 - 20 cm**		**10 - 20 cm**		**0 - 5 cm**		**5 - 10 cm**		**10 - 20 cm**		**0 - 5 cm**	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	1.2	1.2	1.7	1.7	1.55	1.55	4.96	4.96	1.81	1.81	4.6	4.6	0.5	0.5
1,2,3,7,8-PnCDD	1	7.7	7.7	7.7	7.7	12.5	12.5	7.11	7.11	7.04	7.04	16.4	16.4	6.5	6.5
1,2,3,4,7,8-HxCDD	0.1	13.5	1.35	24.2	2.42	13.2	1.32	11.51	1.151	16.06	1.606	20.7	2.07	5.2	0.52
1,2,3,6,7,8-HxCDD	0.1	72.6	7.26	65.8	6.58	66.4	6.64	33.03	3.303	60.9	6.09	141.6	14.16	31.6	3.16
1,2,3,7,8,9-HxCDD	0.1	31.4	3.14	25.5	2.55	31.2	3.12	19.7	1.97	20.92	2.092	59.7	5.97	13	1.3
1,2,3,4,6,7,8-HpCDD	0.01	3223.2	32.232	2513.4	25.134	2640.9	26.409	1022.72	10.2272	1903.78	19.0378	5571.5	55.715	1127.3	11.273
OCDD	0.0001	33418.4	3.34184	29458.7	2.94587	30918.1	3.09181	10346.19	1.034619	19580.8	1.95808	56844.3	5.68443	10750.3	1.07503
2,3,7,8-TCDF	0.1	8.8	0.88	11.1	1.11	7.8	0.78	18.57	1.857	16.52	1.652	16.6	1.66	14.1	1.41
1,2,3,7,8-PnCDF	0.05	4	0.2	5.1	0.255	4.9	0.245	3.63	0.1815	6.51	0.3255	11.7	0.585	3.6	0.18
2,3,4,7,8-PnCDF	0.5	1.6	0.8	5.1	2.55	2.6	1.3	2.15	1.075	4.99	2.495	7.7	3.85	3.8	1.9
1,2,3,4,7,8-HxCDF	0.1	11.1	1.11	20.2	2.02	16.6	1.66	10.31	1.031	11.35	1.135	26.4	2.64	25.7	2.57
1,2,3,6,7,8-HxCDF	0.1	20	2	25.2	2.52	19.8	1.98	5.64	0.564	11.21	1.121	28	2.8	8.7	0.87
1,2,3,7,8,9-HxCDF	0.1	2.4	0.24	6.35	0.635	6.6	0.66	3.915	0.3915	2.77	0.277	7.1	0.71	1.8	0.18
2,3,4,6,7,8-HxCDF	0.1	10.9	1.09	11.9	1.19	14.7	1.47	3.28	0.328	15.21	1.521	13.8	1.38	2.6	0.26
1,2,3,4,6,7,8-HpCDF	0.01	469.9	4.699	466.7	4.667	445.9	4.459	188.69	1.8869	320.72	3.2072	729.3	7.293	221	2.21
1,2,3,4,7,8,9-HpCDF	0.01	39.1	0.391	44.2	0.442	41	0.41	18.72	0.1872	24.2	0.242	76.8	0.768	27.4	0.274
OCDF	0.0001	2316.6	0.23166	2165.2	0.21652	2417.9	0.24179	1105.1	0.11051	1827.85	0.182785	3628.6	0.36286	1195.5	0.11955
PCDD/PCDF TEQ (1/2 ND)			67.8655		64.63539		67.8366		37.36843		51.79237		126.6483		34.30158
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001														
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001														
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001														
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001														
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005														
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001														
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1														
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001														
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005														
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005														
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01														
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001														
PCB TEQ (1/2 ND)															
Total TEQ			67.87		64.64		67.84		37.37		51.79		126.65		34.30

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		EC 2006		EC 2006				EC 2006		EC 2006		EC 2006		EC 2006	
		05TRSED-23		**05TRSED-47**				**05TRSED-52**		**05TRSED-56**		**05TRSED-22**		**05TRSED-12**	
		05PD04		**05PD04**		**Duplicate**		**05PD05**		**05PD05**		**05SD01**		**05SD01**	
		5 - 10 cm		**10 -20 cm**		**10 -20 cm**		**0 - 5 cm**		**5 - 10 cm**		**0 - 5 cm**		**5 - 10 cm**	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	0.75	0.75	2.8	2.8	1.6	1.6	2.1	2.1	0.9	0.9	0.4	0.4	0.55	0.55
1,2,3,7,8-PnCDD	1	9	9	16.1	16.1	12.6	12.6	4.3	4.3	5	5	3.3	3.3	5.2	5.2
1,2,3,4,7,8-HxCDD	0.1	21.8	2.18	54.1	5.41	47	4.7	6	0.6	9.1	0.91	4.5	0.45	7.2	0.72
1,2,3,6,7,8-HxCDD	0.1	143	14.3	243.1	24.31	186.2	18.62	24.6	2.46	36.4	3.64	21	2.1	40.6	4.06
1,2,3,7,8,9-HxCDD	0.1	46.7	4.67	70.4	7.04	52.1	5.21	14.9	1.49	17.1	1.71	7.6	0.76	14.8	1.48
1,2,3,4,6,7,8-HpCDD	0.01	4479.5	44.795	8986.7	89.867	8361.7	83.617	912.9	9.129	1244	12.44	705.6	7.056	1307	13.07
OCDD	0.0001	44131.5	4.41315	92313.8	9.23138	96471	9.6471	8469	0.8469	11669.5	1.16695	6410.2	0.64102	13039.2	1.30392
2,3,7,8-TCDF	0.1	16.4	1.64	18	1.8	16.3	1.63	14.1	1.41	18.3	1.83	6.6	0.66	7.4	0.74
1,2,3,7,8-PnCDF	0.05	7.8	0.39	6.2	0.31	8.7	0.435	3.9	0.195	3.5	0.175	1.3	0.065	2.5	0.125
2,3,4,7,8-PnCDF	0.5	5.3	2.65	5.1	2.55	4.2	2.1	3.4	1.7	4.2	2.1	1.3	0.65	2	1
1,2,3,4,7,8-HxCDF	0.1	22.5	2.25	47.5	4.75	42.2	4.22	9.8	0.98	15.4	1.54	4.2	0.42	8	0.8
1,2,3,6,7,8-HxCDF	0.1	25.6	2.56	43.2	4.32	43.1	4.31	4.6	0.46	5.6	0.56	3.2	0.32	5.7	0.57
1,2,3,7,8,9-HxCDF	0.1	3.1	0.31	7.2	0.72	4.5	0.45	0.7	0.07	0.7	0.07	0.45	0.045	3	0.3
2,3,4,6,7,8-HxCDF	0.1	12.8	1.28	31.6	3.16	31.2	3.12	3.6	0.36	4.6	0.46	1.8	0.18	3.1	0.31
1,2,3,4,6,7,8-HpCDF	0.01	615.8	6.158	1681.6	16.816	1462.9	14.629	181.5	1.815	226.7	2.267	129.4	1.294	228.5	2.285
1,2,3,4,7,8,9-HpCDF	0.01	46.5	0.465	158.2	1.582	113.4	1.134	17.3	0.173	21.1	0.211	10.9	0.109	19.9	0.199
OCDF	0.0001	2807.4	0.28074	9100.8	0.91008	8197.6	0.81976	870.5	0.08705	1195.7	0.11957	829.7	0.08297	1428.8	0.14288
PCDD/PCDF TEQ (1/2 ND)			98.09189		191.6765		168.8419		28.17595		35.09952		18.53299		32.8558
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001														
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001														
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001														
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001														
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005														
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001														
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1														
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001														
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005														
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005														
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01														
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001														
PCB TEQ (1/2 ND)															
Total TEQ			98.09		191.68		168.84		28.18		35.10		18.53		32.86

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		EC 2006		EC 2006		EC 2006				EC 2006		EC 2006		EC 2006	
		05TRSED-04		05TRSED-19		05TRSED-29				05TRSED-21		05TRSED-08		05TRSED-50	
		05SD01		05SD01		05SD02				05SD02		05SD03		05SD03	
		10 - 20 cm		10 - 20 cm		0 - 5 cm		Duplicate		5 - 10 cm		0 - 5 cm		5 - 10 cm	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	1.35	1.35	1.1	1.1	0.45	0.45	0.5	0.5	0.7	0.7	0.55	0.55	1	1
1,2,3,7,8-PnCDD	1	7.3	7.3	10.3	10.3	4.8	4.8	5.2	5.2	5.8	5.8	6.1	6.1	5.3	5.3
1,2,3,4,7,8-HxCDD	0.1	11.8	1.18	19.8	1.98	6.3	0.63	5.2	0.52	8.1	0.81	7.2	0.72	16.8	1.68
1,2,3,6,7,8-HxCDD	0.1	93.2	9.32	111	11.1	21.8	2.18	25.1	2.51	52.5	5.25	37.6	3.76	76.9	7.69
1,2,3,7,8,9-HxCDD	0.1	25.7	2.57	28.8	2.88	8.9	0.89	9	0.9	15.8	1.58	13.1	1.31	21.7	2.17
1,2,3,4,6,7,8-HpCDD	0.01	3220.2	32.202	4355	43.55	683.9	6.839	810	8.1	1627.3	16.273	1188.1	11.881	2976.3	29.763
OCDD	0.0001	32186.9	3.21869	47336.1	4.73361	6895.7	0.68957	8100.6	0.81006	19037.4	1.90374	12308	1.2308	29770.3	2.97703
2,3,7,8-TCDF	0.1	19	1.9	22.7	2.27	7.4	0.74	7.2	0.72	8.4	0.84	8.7	0.87	13.6	1.36
1,2,3,7,8-PnCDF	0.05	6.4	0.32	6.7	0.335	2	0.1	2.4	0.12	2.2	0.11	3.2	0.16	4.3	0.215
2,3,4,7,8-PnCDF	0.5	3.9	1.95	5.1	2.55	4.8	2.4	0.55	0.275	2.2	1.1	2.5	1.25	4.6	2.3
1,2,3,4,7,8-HxCDF	0.1	21.6	2.16	19.4	1.94	8	0.8	6.7	0.67	10.5	1.05	7.2	0.72	35.5	3.55
1,2,3,6,7,8-HxCDF	0.1	24.9	2.49	21.1	2.11	3.6	0.36	2.4	0.24	7	0.7	5.6	0.56	13.5	1.35
1,2,3,7,8,9-HxCDF	0.1	3.6	0.36	4.05	0.405	2	0.2	0.9	0.09	1.05	0.105	2	0.2	4.8	0.48
2,3,4,6,7,8-HxCDF	0.1	11.3	1.13	17	1.7	4.9	0.49	6.3	0.63	4.5	0.45	4.1	0.41	9.1	0.91
1,2,3,4,6,7,8-HpCDF	0.01	623.8	6.238	776.6	7.766	133.2	1.332	139.7	1.397	320.5	3.205	209.4	2.094	481.2	4.812
1,2,3,4,7,8,9-HpCDF	0.01	51.5	0.515	62.7	0.627	12.4	0.124	13.4	0.134	22.3	0.223	18.4	0.184	55.2	0.552
OCDF	0.0001	3621.9	0.36219	5012.4	0.50124	692.2	0.06922	854.8	0.08548	1986.5	0.19865	1366.8	0.13668	2674.6	0.26746
PCDD/PCDF TEQ (1/2 ND)			74.56588		95.84785		23.09379		22.90154		40.29839		32.13648		66.37649
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001														
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001														
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001														
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001														
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005														
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001														
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1														
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001														
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005														
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005														
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01														
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001														
PCB TEQ (1/2 ND)															
Total TEQ			74.57		95.85		23.09		22.90		40.30		32.14		66.38

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		EC 2006		EC 2006		EC 2006		EC 2006		EC 2006		EC 2006	
		05TRSED-54		**05TRSED-01**		**05TRSED-24**		**05TRSED-16**				**05TRSED-49**	
		05WS01		**05WS01**		**05WS01**		**05WS01**		**Duplicate**		**Ponar1**	
		0 - 5 cm		**5 - 10 cm**		**10 - 20 cm**		**10 - 20 cm**				**0 - 10 cm**	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	0.85	0.85	0.5	0.5	1.2	1.2	0.7	0.7	0.9	0.9	1.06	1.06
1,2,3,7,8-PnCDD	1	2.7	2.7	3.2	3.2	3.8	3.8	4.5	4.5	4.9	4.9	5.33	5.33
1,2,3,4,7,8-HxCDD	0.1	4.5	0.45	5.1	0.51	4.6	0.46	5.5	0.55	6.2	0.62	9.82	0.982
1,2,3,6,7,8-HxCDD	0.1	16.3	1.63	29.6	2.96	26.1	2.61	26.8	2.68	26.7	2.67	36.35	3.635
1,2,3,7,8,9-HxCDD	0.1	11	1.1	15.3	1.53	11.5	1.15	10.1	1.01	10.8	1.08	15.27	1.527
1,2,3,4,6,7,8-HpCDD	0.01	495.5	4.955	838.1	8.381	647.7	6.477	778.4	7.784	777.6	7.776	1129.15	11.2915
OCDD	0.0001	4801.8	0.48018	7344.1	0.73441	5931	0.5931	7430.6	0.74306	7154.8	0.71548	10622.64	1.062264
2,3,7,8-TCDF	0.1	16.1	1.61	13.5	1.35	17.5	1.75	18.9	1.89	18.7	1.87	17.28	1.728
1,2,3,7,8-PnCDF	0.05	3.6	0.18	3.5	0.175	4.5	0.225	4.8	0.24	4.6	0.23	3.93	0.1965
2,3,4,7,8-PnCDF	0.5	9.2	4.6	3.9	1.95	3.5	1.75	4.6	2.3	3.9	1.95	5.7	2.85
1,2,3,4,7,8-HxCDF	0.1	5.7	0.57	6.9	0.69	10.1	1.01	10.4	1.04	6.3	0.63	9.93	0.993
1,2,3,6,7,8-HxCDF	0.1	5.2	0.52	6.2	0.62	8.7	0.87	10.1	1.01	8.8	0.88	6.33	0.633
1,2,3,7,8,9-HxCDF	0.1	1.3	0.13	1.6	0.16	0.9	0.09	1.5	0.15	1.2	0.12	1.555	0.1555
2,3,4,6,7,8-HxCDF	0.1	3.3	0.33	3.5	0.35	4.9	0.49	5.1	0.51	4.2	0.42	1.305	0.1305
1,2,3,4,6,7,8-HpCDF	0.01	105.5	1.055	222.4	2.224	138.3	1.383	153.2	1.532	141.3	1.413	228.92	2.2892
1,2,3,4,7,8,9-HpCDF	0.01	10.2	0.102	24.2	0.242	15.2	0.152	17.8	0.178	11.5	0.115	16.52	0.1652
OCDF	0.0001	479.7	0.04797	1006.2	0.10062	547.7	0.05477	716.2	0.07162	652.2	0.06522	1139.15	0.113915
PCDD/PCDF TEQ (1/2 ND)			21.31015		25.67703		24.06487		26.88868		26.3547		34.14258
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001												
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001												
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001												
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001												
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005												
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001												
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1												
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001												
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005												
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005												
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01												
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001												
PCB TEQ (1/2 ND)													
Total TEQ			21.31		25.68		24.06		26.89		26.35		34.14

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		EC 2006				EC 2006		MOE Split Samples 2006		MOE Split Samples 2006		MOE Split Samples 2006		MOE Split Samples 2006	
		05TRSED-18				05TRSED-07		05 TR-SED-07		05 TR-SED-011		05 TR-SED-018		05 TR-SED-20	
		Ponar2				Ponar3		Ponar 3 (upstream)		05PD01		Ponar 2 (upstream)		05PD03	
		0 - 10 cm		Duplicate		0 - 10 cm				0 to 5 cm				5 to 10 cm	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	0.155	0.155	0.32	0.32	0.47	0.47	0.255	0.255	0.6	0.6	0.355	0.355	0.355	0.355
1,2,3,7,8-PnCDD	1	2.89	2.89	2.17	2.17	3.4	3.4	1.3	1.3	3.1	3.1	0.42	0.42	4	4
1,2,3,4,7,8-HxCDD	0.1	0.475	0.0475	0.59	0.059	1.31	0.131	1.9	0.19	6.9	0.69	0.465	0.0465	9.4	0.94
1,2,3,6,7,8-HxCDD	0.1	0.99	0.099	1.36	0.136	5.81	0.581	4.3	0.43	27	2.7	1.2	0.12	49	4.9
1,2,3,7,8,9-HxCDD	0.1	2.03	0.203	1.38	0.138	4.22	0.422	4.6	0.46	15	1.5	1.2	0.12	29	2.9
1,2,3,4,6,7,8-HpCDD	0.01	24.67	0.2467	25.39	0.2539	136.35	1.3635	110	1.1	970	9.7	23	0.23	2000	20
OCDD	0.0001	141.89	0.014189	158.09	0.015809	1045.71	0.104571	970	0.097	8500	0.85	160	0.016	22000	2.2
2,3,7,8-TCDF	0.1	1.29	0.129	1.27	0.127	10.4	1.04	8.7	0.87	12	1.2	0.5	0.05	13	1.3
1,2,3,7,8-PnCDF	0.05	0.57	0.0285	0.67	0.0335	1.94	0.097	2.1	0.105	2.9	0.145	0.235	0.01175	4.4	0.22
2,3,4,7,8-PnCDF	0.5	0.225	0.1125	0.26	0.13	2.17	1.085	1.7	0.85	2.6	1.3	0.26	0.13	3.3	1.65
1,2,3,4,7,8-HxCDF	0.1	0.67	0.067	0.88	0.088	1.97	0.197	2.1	0.21	7.3	0.73	0.445	0.0445	7.8	0.78
1,2,3,6,7,8-HxCDF	0.1	0.64	0.064	0.89	0.089	1.81	0.181	2	0.2	4.9	0.49	0.415	0.0415	10	1
1,2,3,7,8,9-HxCDF	0.1	0.295	0.0295	0.95	0.095	0.32	0.032	0.47	0.047	1.3	0.13	0.6	0.06	1.4	0.14
2,3,4,6,7,8-HxCDF	0.1	0.25	0.025	0.32	0.032	1.27	0.127	1.8	0.18	4.2	0.42	0.485	0.0485	5.8	0.58
1,2,3,4,6,7,8-HpCDF	0.01	5.5	0.055	6.03	0.0603	20.16	0.2016	16	0.16	150	1.5	2.3	0.023	310	3.1
1,2,3,4,7,8,9-HpCDF	0.01	0.51	0.0051	1.13	0.0113	0.96	0.0096	0.95	0.0095	12	0.12	0.36	0.0036	20	0.2
OCDF	0.0001	12.07	0.001207	14.05	0.001405	50.46	0.005046	36	0.0036	730	0.073	11	0.0011	1400	0.14
PCDD/PCDF TEQ (1/2 ND)			4.172196		3.760214		9.447317		6.4671		25.248		1.72145		44.405
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001							12	0.0012	6.4	0.00064	0.71	0.000071	8.9	0.00089
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001							470	0.047	390	0.039	36	0.0036	500	0.05
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001							68	0.0068	110	0.011	6.4	0.00064	91	0.0091
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001							2100	0.21	2700	0.27	180	0.018	2300	0.23
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005							65	0.0325	77	0.0385	6.2	0.0031	64	0.032
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001							990	0.099	1300	0.13	83	0.0083	1000	0.1
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1							14	1.4	22	2.2	1.4	0.14	17	1.7
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001							63	0.00063	150	0.0015	6.9	0.000069	93	0.00093
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005							150	0.075	330	0.165	16	0.008	210	0.105
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005							34	0.017	79	0.0395	5.1	0.00255	54	0.027
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01							0.92	0.0092	2	0.02	0.29	0.0029	1.4	0.014
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001							12	0.0012	30	0.003	1.8	0.00018	20	0.002
PCB TEQ (1/2 ND)									1.89953		2.91814		0.18741		2.27092
Total TEQ			4.17		3.76		9.45		8.37		28.17		1.91		46.68

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		MOE Split Samples 2006		MOE Split Samples 2006		MOE Split Samples 2006		MOE 2005		MOE 2005		MOE 2005		MOE 2005	
		05 TR-SED-27		**05 TR-SED-46**		**05 TR-SED-49**		**NORAM2**		**NORAM3**		**NORAM7**		**NORAM8**	
		05PD01		**05PD03**		**Ponar 3**									
		5 to 10 cm		**0 to 5 cm**				**Grab Sample**		**Grab Sample**		**Grab Sample**		**Grab Sample**	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	0.27	0.27	0.29	0.29	0.5	0.5	0.45	0.45	0.18	0.18	0.51	0.51	1.2	1.2
1,2,3,7,8-PnCDD	1	3.7	3.7	2.1	2.1	3.1	3.1	2.1	2.1	0.92	0.92	3.1	3.1	6.9	6.9
1,2,3,4,7,8-HxCDD	0.1	11	1.1	7.2	0.72	9	0.9	4.6	0.46	2.2	0.22	12	1.2	17	1.7
1,2,3,6,7,8-HxCDD	0.1	28	2.8	27	2.7	34	3.4	15	1.5	4.9	0.49	95	9.5	54	5.4
1,2,3,7,8,9-HxCDD	0.1	23	2.3	16	1.6	17	1.7	10	1	3.4	0.34	26	2.6	37	3.7
1,2,3,4,6,7,8-HpCDD	0.01	950	9.5	1000	10	1200	12	540	5.4	170	1.7	4100	41	1400	14
OCDD	0.0001	9400	0.94	10000	1	12000	1.2	6100	0.61	1700	0.17	44000	4.4	12000	1.2
2,3,7,8-TCDF	0.1	13	1.3	16	1.6	16	1.6	0.6	0.06	0.41	0.041	4.4	0.44	13	1.3
1,2,3,7,8-PnCDF	0.05	3.9	0.195	3.1	0.155	5	0.25	0.86	0.043	0.3	0.015	1.4	0.07	3.9	0.195
2,3,4,7,8-PnCDF	0.5	4.1	2.05	3.1	1.55	3	1.5	0.91	0.455	0.41	0.205	1.5	0.75	4.7	2.35
1,2,3,4,7,8-HxCDF	0.1	7	0.7	6.7	0.67	9.1	0.91	3.1	0.31	1	0.1	13	1.3	13	1.3
1,2,3,6,7,8-HxCDF	0.1	5.7	0.57	6.5	0.65	6.4	0.64	2	0.2	0.79	0.079	6	0.6	17	1.7
1,2,3,7,8,9-HxCDF	0.1	1.05	0.105	1.05	0.105	1.15	0.115	0.58	0.058	0.26	0.026	0.57	0.057	1.2	0.12
2,3,4,6,7,8-HxCDF	0.1	5.6	0.56	3.4	0.34	2.8	0.28	1.8	0.18	0.72	0.072	4.5	0.45	9	0.9
1,2,3,4,6,7,8-HpCDF	0.01	190	1.9	200	2	210	2.1	110	1.1	27	0.27	690	6.9	300	3
1,2,3,4,7,8,9-HpCDF	0.01	13	0.13	12	0.12	20	0.2	6.1	0.061	1.8	0.018	44	0.44	18	0.18
OCDF	0.0001	880	0.088	980	0.098	1000	0.1	490	0.049	99	0.0099	3200	0.32	880	0.088
PCDD/PCDF TEQ (1/2 ND)			28.208		25.698		30.495		14.036		4.8559		73.637		45.233
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001	9.7	0.00097	11	0.0011	10	0.001								
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001	520	0.052	600	0.06	580	0.058								
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001	200	0.02	89	0.0089	96	0.0096								
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001	5200	0.52	2500	0.25	2600	0.26								
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005	130	0.065	73	0.0365	71	0.0355								
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001	2100	0.21	1300	0.13	1200	0.12								
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1	34	3.4	20	2	21	2.1								
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001	300	0.003	100	0.001	100	0.001								
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005	630	0.315	250	0.125	240	0.12								
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005	160	0.08	52	0.026	61	0.0305								
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01	2.9	0.029	1.4	0.014	1.7	0.017								
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001	53	0.0053	23	0.0023	26	0.0026								
PCB TEQ (1/2 ND)			4.70027		2.6548		2.7552								
Total TEQ			32.91		28.35		33.25		14.04		4.86		73.64		45.23
											#REF!				

Table A3 - Lower Trent River
WHO TEQ Calculations, Sediment (<20 cm) Data

		MOE 2005		MOE 2005		MOE 2005		MOE 2005		MOE 2005		MOE 2005		
		NORAM9		**NORREF2**		**NOR9**		**NOR10**		**NOR11**		**NOR12**		**Maximum TEQ**
		Grab Sample		**Grab Sample**		**Grab Sample**		**Grab Sample**		**Grab Sample**		**Grab Sample**		
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	
2,3,7,8-TCDD	1	0.34	0.34	2.2	2.2	1.1	1.1	0.6	0.6	0.5	0.5	0.79	0.79	
1,2,3,7,8-PnCDD	1	1.2	1.2	8.5	8.5	5.3	5.3	1	1	3.6	3.6	2.6	2.6	
1,2,3,4,7,8-HxCDD	0.1	7.3	0.73	9.6	0.96	8.6	0.86	4.4	0.44	8	0.8	2	0.2	
1,2,3,6,7,8-HxCDD	0.1	55	5.5	12	1.2	25	2.5	17	1.7	40	4	15	1.5	
1,2,3,7,8,9-HxCDD	0.1	11	1.1	12	1.2	14	1.4	7.5	0.75	19	1.9	6.5	0.65	
1,2,3,4,6,7,8-HpCDD	0.01	2900	29	230	2.3	1200	12	680	6.8	1500	15	410	4.1	
OCDD	0.0001	33000	3.3	1600	0.16	12000	1.2	7600	0.76	18000	1.8	5400	0.54	
2,3,7,8-TCDF	0.1	5.3	0.53	18	1.8	21	2.1	8.3	0.83	19	1.9	15	1.5	
1,2,3,7,8-PnCDF	0.05	0.94	0.047	8.3	0.415	4.6	0.23	1.5	0.075	2.4	0.12	3.2	0.16	
2,3,4,7,8-PnCDF	0.5	1	0.5	9.2	4.6	5.4	2.7	1.9	0.95	3.5	1.75	3.6	1.8	
1,2,3,4,7,8-HxCDF	0.1	6.5	0.65	11	1.1	8.3	0.83	5.5	0.55	9	0.9	6.4	0.64	
1,2,3,6,7,8-HxCDF	0.1	2.6	0.26	6.5	0.65	5	0.5	1	0.1	5.2	0.52	4.9	0.49	
1,2,3,7,8,9-HxCDF	0.1	0.25	0.025	6.2	0.62	4	0.4	2	0.2	3	0.3	4	0.4	
2,3,4,6,7,8-HxCDF	0.1	2.1	0.21	7.4	0.74	4.2	0.42	1.6	0.16	4.3	0.43	3	0.3	
1,2,3,4,6,7,8-HpCDF	0.01	440	4.4	30	0.3	200	2	130	1.3	310	3.1	81	0.81	
1,2,3,4,7,8,9-HpCDF	0.01	22	0.22	8.4	0.084	15	0.15	5.3	0.053	15	0.15	4	0.04	
OCDF	0.0001	2300	0.23	77	0.0077	1200	0.12	700	0.07	1600	0.16	400	0.04	
PCDD/PCDF TEQ (1/2 ND)			48.242		26.8367		33.81		16.338		36.93		16.56	191.67646
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001													
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001													
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001													
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001													
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005													
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001													
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1													
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001													
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005													
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005													
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01													
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001													
PCB TEQ (1/2 ND)														4.70027
Total TEQ			48.24		26.84		33.81		16.34		36.93		16.56	191.68

Table A4 - Lower Trent River
PCB Analyses in Sediment (<20 cm)

Ontario Ministry of the Environment			Environment Canada			Environment Canada			Environment Canada		
Sample Location	Sample Depth (cm)	Concentration in Sediment (ng/g) (Total PCB)	Sample Location	Sample Depth (cm)	Concentration in Sediment (ng/g) (Total PCB)	Sample Location	Sample Depth (cm)	Concentration in Sediment (ng/g) (Total PCB)	Sample Location	Sample Depth (cm)	Concentration in Sediment (ng/g) (Total PCB)
NORAM2	Grab	20	05TRSED-11	0-5	60	05TRSED-20	5-10	70	05TRSED-34	20-30	270
NORAM3	Grab	20	05TRSED-25	10-20	80	05TRSED-39	10-20	120	05TRSED-42	35-39	440
NORAM7	Grab	20	05TRSED-38	0-5	90	05TRSED-32	20-30	110	05TRSED-40	10-20	100
NORAM8	Grab	120	05TRSED-36	5-10	100	05TRSED-13	30-40	320	05TRSED-28	40-44	240
NORAM9	Grab	21	05TRSED-15	10-20	60	05TRSED-41	30-40	230	05TRSED-22	0-5	200
NORREF2	Grab	63	05TRSED-02	10-20	50	05TRSED-45	30-40	220	05TRSED-12	5-10	320
NOR9	Grab	63	05TRSED-31	10-20	60	05TRSED-30	40-50	570	05TRSED-44	10-20	330
NOR10	Grab	35	05TRSED-37	20-30	70	05TRSED-03	50-54	200	05TRSED-04	10-20	320
NOR11	Grab	73	05TRSED-48	30-40	20	05TRSED-23	5-10	120	05TRSED-19	10-20	290
NOR12	Grab	61	05TRSED-35	45-50	180	05TRSED-47	10-20	120	05TRSED-43	20-30	130

Table A4 - Lower Trent River
PCB Analyses in Sediment (<20 cm)

Environment Canada			Environment Canada		
Sample Location	**Sample Depth (cm)**	**Concentration in Sediment (ng/g) (Total PCB)**	**Sample Location**	**Sample Depth (cm)**	**Concentration in Sediment (ng/g) (Total PCB)**
05TRSED-29	0-5	50	05TRSED-24	10-20	180
05TRSED-21	5-10	50	05TRSED-33	20-30	410
05TRSED-53	10-20	150	05TRSED-14	30-35	120
05TRSED-05	25-30	450	05TRSED-07	0-10	70
05TRSED-08	0-5	90	BQ10	0-5cm	132
05TRSED-50	5-10	50	BQ10	5-15cm	177
05TRSED-17	10-20	200	BQ10	15-25cm	242
05TRSED-01	5-10	90	Maximum Concentration (ng/g)		**570**
05TRSED-06	10-20	200	MOE (2004) Table 3 Residential Standard, Coarse Soil, Non-Potable Ground Water Condition (ng/g)		**5000**
05TRSED-16	10-20	170			

Table A5 - Lower Trent River
Chlorobenzenes and Pesticides Analyses in Sediment (<20 cm)

Compound	Ontario Ministry of the Environment Sample Locations										Maximum Concentration (ng/g)	Screening Standards	
	NORAM2	NORAM3	NORAM7	NORAM8	NORAM9	NORREF2	NOR9	NOR10	NOR11	NOR12		(ng/g)	Source
Organochlorine Pesticides													
Heptachlor	1	1	1	1	1	1	1	1	1	1	1	120	MOE 2004
Aldrin	1	1	2	1	1	1	1	1	1	1	2	50	MOE 2004
pp-DDE	3	2	1	22	1	3	9	5	9	10	22	1600	MOE 2004
Mirex	5	5	5	5	5	5	5	5	5	5	5	6400	EPA, 2005
a-BHC (hexachlorocyclohexane)	1	1	1	1	1	1	1	1	1	1	1	40	EPA, 2005
b-BHC (hexachlorocyclohexane)	1	1	1	1	1	1	1	1	1	1	1	14	EPA, 2005
a-Chlordane	2	2	2	2	2	2	2	2	2	2	2	290	MOE 2004
g-BHC (hexachlorocyclohexane)	1	1	1	1	1	1	1	1	1	1	1	410	MOE 2004
g-Chlordane	2	2	2	2	2	2	2	2	2	2	2	290	MOE 2004
Oxychlordane	2	2	2	2	2	2	2	2	2	2	2	N.V.	
op-DDT	5	5	5	5	5	5	5	5	5	5	5	1600	MOE 2004
pp-DDD	5	5	5	5	5	5	5	5	5	5	5	2200	MOE 2004
pp-DDT	5	5	5	5	5	5	5	5	5	5	5	1600	MOE 2004
Methoxychlor	5	5	5	5	5	5	5	5	5	5	5	4000	MOE 2004
Heptachlor epoxide	1	1	1	1	1	1	1	1	1	1	1	60	MOE 2004
Endosulphan I	2	2	2	2	2	2	2	2	2	2	2	290	MOE 2004
Dieldrin	2	2	2	2	2	2	2	2	2	2	2	50	MOE 2004
Endrin	4	4	4	4	4	4	4	4	4	4	4	50	MOE 2004
Endosulphan II	4	4	4	4	4	4	4	4	4	4	4	290	MOE 2004
Endosulphan sulphate	4	4	4	4	4	4	4	4	4	4	4	290	MOE 2004
Toxaphene	50	50	50	50	50	50	50	50	50	50	50	232	EPA, 2005
Other Organochlorine Compounds													
Octachlorostyrene	1	2	1	2	1	2	2	1	2	1	2	N.V.	
Hexachlorobutadiene	1	1	1	1	1	1	1	1	1	1	1	2400	MOE 2004
1,2,3-tichlorobenzene	2	2	2	2	2	2	2	2	2	2	2	N.V.	
1,2,3,4-tetrachlorobenzene	1	1	1	1	1	1	1	1	1	1	1	N.V.	
1,2,3,5-tetrachlorobenzene	1	1	1	1	1	1	1	1	1	1	1	N.V.	
1,2,4-trichlorobenzene	1	1	2	1	2	1	1	1	2	2	2	30000	MOE 2004
1,2,4,5-tetrachlorobenzene	1	1	1	1	1	1	1	1	1	1	1	9200	EPA, 2005
1,3,5-trichlorobenzene	2	2	2	2	2	2	2	2	2	2	2	N.V.	
Hexachloroethane	1	1	1	1	1	1	1	1	1	1	1	6300	MOE 2004
Pentachlorobenzene	1	1	1	1	1	1	1	1	1	1	1	25000	EPA, 2005
2,3,6-trichlorotoluene	1	1	1	1	1	1	1	1	1	1	1	N.V.	
2,4,5-trichlorotoluene	1	1	1	1	1	1	1	1	1	1	1	N.V.	
2,6-dichlorobenzyl chloride	2	1	1	1	1	1	1	1	1	1	2	N.V.	
Hexachlorobenzene	1	1	1	1	1	1	1	1	1	1	1	460	MOE 2004

Notes:
MOE (2004), Table 3 Criteria, Residential/Parkland Use, Coarse Soils in a Non-potable Ground Water Condition
US EPA (2005), Risk-Based Concentration Tables, Residential Soils

Table A6 - Lower Trent River
Metals Analyses in Sediment (<20 cm)

Metal	Ontario Ministry of the Environment Sample Locations									
	NORAM2	NORAM3	NORAM7	NORAM8	NORAM9	NORREF2	NOR9	NOR10	NOR11	NOR12
	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Aluminum	8800	5800	3500	8200	3100	12000	13000	6800	11000	9100
Antimony										
Arsenic	4	1.6	0.6	5.2	0.7	1.1	1.4	1.1	1.2	1.3
barium	84	77	22	110	20	100	140	74	130	120
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	0.4	0.6	0.2	1	0.2	0.6	0.7	0.4	0.3	0.7
Chromium	14	10	7	28	8	26	31	15	26	25
Cobalt	5.6	3.4	2.4	5	1.8	6.1	5.1	3.4	4.8	4.3
Copper	13	11	12	88	26	24	36	48	34	25
Lead	9	7	7	130	19	31	36	23	31	38
Manganese	360	290	170	240	180	280	500	320	520	390
Mercury										
Molybdenum	4.2	0.5	0.5	1.2	0.5	0.5	0.5	0.5	0.5	0.5
Nickel	9.8	7.2	4.5	12	4.4	13	14	7.3	12	9.9
Selenium	0.2	0.2	0.2	0.5	0.2	0.7	0.9	0.5	1	0.9
Strontium	220	250	110	180	85	87	110	150	110	150
Thallium										
Titanium	360	280	210	290	280	510	560	460	450	460
Uranium										
Vanadium	18	15	10	20	10	23	29	17	24	21
Zinc	67	60	23	270	26	120	160	61	110	120

Notes:

MOE (2004), Table 3 Criteria, Residential/Parkland Use, Coarse Soils in a Non-potable Ground Water Condition
US EPA (2005), Risk-Based Concentration Tables, Residential Soils

Table A6 - Lower Trent River
Metals Analyses in Sediment (<20 cm)

Metal	Environment Canada Sample Locations										
	05TRSED-11	05TRSED-27	05TRSED-38	05TRSED-36	05TRSED-46	05TRSED-20	05TRSED-55	05TRSED-23	05TRSED-52	05TRSED-56	05TRSED-22
	05PD01	05PD01	05PD02	05PD02	05PD03	05PD03	05PD04	05PD04	05PD05	05PD05	05SD01
	0-5	5-10	0-5	5-10	0-5	5-10	0-5	5-10	0-5	5-10	0-5
Aluminum	13900	16500	13300	13900	19100	19200	19700	20100	19800	20100	15800
Antimony	0.6	0.9	0.9	1.8	0.3	0.8	0.3	1.2	1	0.6	1.8
Arsenic	4	4	3	3	4	4	4	4	3	4	2
barium	136	161	84	82	149	117	160	127	169	162	97
Beryllium	0.55	0.61	0.47	0.47	0.77	0.72	0.69	0.7	0.69	0.72	0.62
Cadmium	0.7	0.9	0.5	0.8	0.7	0.8	0.7	0.9	0.6	0.7	0.3
Chromium	42	48	32	40	43	44	43	49	39	43	26
Cobalt	5.9	6.6	5	5.2	7.6	8	6.8	7.3	6.8	7	5.5
Copper	48	61	47	76	41	59	38	68	41	40	97
Lead	59.5	66.1	48.5	83.3	48.9	64.1	44.4	65.2	43.8	46.3	145
Manganese	354	416	307	307	592	417	582	429	**702**	545	258
Mercury	0.212	0.246	0.105	0.144	0.162	0.161	0.173	0.211	0.165	0.168	0.121
Molybdenum	1.1	1.3	0.6	0.6	0.7	0.6	0.6	0.7	0.8	0.7	0.5
Nickel	17.6	20.3	14.6	17.8	20.6	21.7	18.7	21.6	18.3	19.5	14.2
Selenium											
Strontium	147	135	123	113	131	110	132	102	126	117	150
Thallium	0.212	0.244	0.176	0.188	0.27	0.292	0.25	0.261	0.251	0.262	0.248
Titanium											
Uranium	1.1	1.22	0.82	0.82	1.12	1.13	1.08	1.09	1.14	1.06	0.67
Vanadium	34	38	31	32	39	40	40	41	38	40	23
Zinc	309	382	102	124	141	143	141	145	137	135	92

Notes:

MOE (2004), T

US EPA (2005

Table A6 - Lower Trent River
Metals Analyses in Sediment (<20 cm)

Metal	Environment Canada Sample Locations									
	05TRSED-12	05TRSED-29	05TRSED-21	05TRSED-08	05TRSED-50	05TRSED-54	05TRSED-01	05TRSED-49	05TRSED-18	05TRSED-07
	05SD01	05SD02	05SD02	05SD03	05SD03	05WS01	05WS01	Ponar1	Ponar2	Ponar3
	5-10	0-5	5-10	0-5	5-10	0-5	5-10	0-10	0-10	0-10
Aluminum	15400	14100	14300	13200	14600	18500	18000	17000	6190	16100
Antimony	2.7	2.2	0.9	1	1.8	1.2	1.3	0.3	0.1	0.5
Arsenic	2	2	2	2	3	3	3	3	2	3
barium	86	99	85	82	86	161	139	127	42	98
Beryllium	0.55	0.48	0.48	0.49	0.53	0.71	0.66	0.63	0.24	0.66
Cadmium	0.4	0.3	0.4	0.4	0.6	0.6	0.7	0.7	0.1	0.7
Chromium	27	30	34	27	37	45	42	38	10	41
Cobalt	5.1	5.4	5.5	5.3	5.7	7	7	6.5	3.2	6.9
Copper	167	77	105	79	103	27	33	32	8	30
Lead	**231**	44.2	54.6	44.7	58.9	45.8	45.3	36.8	8.7	41.3
Manganese	222	379	325	355	353	**760**	552	508	282	416
Mercury	0.139	0.134	**32.4**	0.124	0.205	0.153	0.162	0.152	0.025	0.124
Molybdenum	0.5	0.6	0.5	0.5	0.6	0.8	0.9	0.5	0.5	1
Nickel	14.2	13.8	14.5	14.2	16.7	19.6	18.9	16.9	6.9	18.1
Selenium										
Strontium	154	115	113	105	96	130	119	128	122	189
Thallium	0.21	0.201	0.246	0.213	0.23	0.26	0.266	0.222	0.082	0.256
Titanium										
Uranium	0.67	0.99	0.85	0.77	0.92	0.97	1.08	1.02	0.6	0.76
Vanadium	25	29	29	27	32	38	36	36	17	33
Zinc	91	90	119	85	118	137	127	123	30	128

Notes:

MOE (2004), T

US EPA (2005

Table A6 - Lower Trent River
Metals Analyses in Sediment (<20 cm)

Metal	Maximum Concentration (µg/g)	95th Percentile Concentration (ug/g)	Screening Standards	
			(µg/g)	Source
Aluminum	20100		31200	EPA, 2005
Antimony	2.7		40	MOE 2004
Arsenic	5.2		20	MOE 2004
barium	169		750	MOE 2004
Beryllium	0.77		1.2	MOE 2004
Cadmium	1		12	MOE 2004
Chromium	49		750	MOE 2004
Cobalt	8		40	MOE 2004
Copper	167		225	MOE 2004
Lead	**231**	**137.5**	200	MOE 2004
Manganese	**760**	**647**	640	MOE 2004
Mercury	**32.4**	**0.246**	10	MOE 2004
Molybdenum	4.2		40	MOE 2004
Nickel	21.7		150	MOE 2004
Selenium	1		10	MOE 2004
Strontium	250		18800	EPA, 2005
Thallium	0.292		4.1	MOE 2004
Titanium	560		124000	EPA, 2005
Uranium	1.22		92	EPA, 2005
Vanadium	41		200	MOE 2004
Zinc	382		600	MOE 2004

Notes:
MOE (2004), T
US EPA (2005

Table A7 - Lower Trent River
PAH Analyses in Sediment (<20 cm)

PAH	Ontario Ministry of the Environment Sample Locations									
	NORAM2	NORAM3	NORAM7	NORAM8	NORAM9	NORREF2	NOR9	NOR10	NOR11	NOR12
	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Napthalene	20	24	110	59	40	28	26	150	54	20
1-Methylnaphthalene										
2-Methylnaphthalene										
Acenapthylene	20	20	130	25	20	20	20	20	27	20
Acenapthene	20	20	1100	39	33	20	30	58	75	20
Fluorene	20	25	690	60	44	20	51	110	150	20
Phenanthrene	91	160	1500	520	160	93	310	380	1100	160
Anthracene	20	23	450	120	82	20	74	140	240	49
Fluoranthene	140	130	2400	1200	340	290	600	530	1700	380
Pyrene	120	110	1800	1000	260	210	440	390	1300	310
Benz[a]anthracene	55	37	980	530	140	90	190	220	590	160
Chrysene	75	73	1100	870	180	160	290	270	810	210
Benzo[b]fluroanthene	87	33	1500	1100	260	170	370	320	740	280
Benzo[k]fluoranthene	42	20	550	400	110	84	130	130	280	130
Benzo[a]pyrene	59	40	1000	630	160	82	190	210	460	180
Indeno[1,2,3-c,d]pyrene	46	40	770	640	130	83	180	170	360	160
Dibenz[a,h]anthracene	40	40	120	110	40	40	40	40	78	45
Benzo[ghi]perylene	44	40	570	560	110	78	160	140	270	140

Table A7 - Lower Trent River
PAH Analyses in Sediment (<20 cm)

PAH	Environment Canada Sample Locations												
	TR-01	TR-01	TR-01	TR-07	TR-07	TR-07	TR-12	TR-12	TR-12	05TRSED-54	05TRSED-01	05TRSED-18	05TRSED-07
	0-5 cm	5-10 cm	10-20 cm	0-5 cm	5-10 cm	10-20 cm	0-5 cm	5-10 cm	10-20 cm	0-5 cm	5-10 cm	0-10 cm	0-10 cm
Napthalene	0	0	0	0	0	0	136	0	0			6	
1-Methylnaphthalene												6	
2-Methylnaphthalene												6	
Acenapthylene	0	0	0	0	0	0	0	0	0				
Acenapthene	0	0	119	0	0	0	140	0	126				
Fluorene	0	0	127	0	0	107	278	160	166			11	30
Phenanthrene	0	216	805	165	434	589	1530	614	873	230	140	121	190
Anthracene	0	0	209	0	100	197	1420	957	461	60	50	14	40
Fluoranthene	143	409	1060	346	796	1570	2220	855	1480	510	410	221	530
Pyrene	151	372	982	316	717	1640	1660	741	1290	420	350	172	440
Benz[a]anthracene	88.1	275	445	156	342	839	972	505	628	180	180	80	220
Chrysene	89.7	239	346	142	213	849	907	600	700	160	160	70	200
Benzo[b]fluroanthene	0	272	409	0	240	703	761	570	554	270	280	122	340
Benzo[k]fluoranthene	0	313	365	0	0	728	641	647	486	100	110	40	140
Benzo[a]pyrene	0	214	338	0	170	652	730	593	725	170	170	73	180
Indeno[1,2,3-c,d]pyrene	0	0	305	0	0	396	401	350	242		100	50	150
Dibenz[a,h]anthracene	0	0	0	0	0	104	109	0	0				
Benzo[ghi]perylene	0	0	0	0	0	0	0	0	0		100	50	130

Table A7 - Lower Trent River
PAH Analyses in Sediment (<20 cm)

PAH	Environment Canada Sample Locations			Maximum Concentration (ng/g)	95th Percentile Concentration (ng/g)	MOE (2004) Table 3 Residental Standards (ng/g), Coarse Soil, Non-potable Ground Water Condition
	BQ10 0-5cm	BQ10 5-15cm	BQ10 15-25cm			
Napthalene	25	25	25	150		40000
1-Methylnaphthalene	40.6	40.6	40.6	40.6		280000
2-Methylnaphthalene	36.3	36.3	36.3	36.3		280000
Acenapthylene	41.6	41.6	41.6	130		1000000
Acenapthene	57.5	706	1410	1410		100000
Fluorene	53.5	769	1540	1540		350000
Phenanthrene	983	4910	12100	12100		40000
Anthracene	221	855	1810	1810		28000
Fluoranthene	1780	4490	14800	14800		40000
Pyrene	1300	3140	14600	14600		250000
Benz[a]anthracene	579	1230	2820	2820		40000
Chrysene	550	1010	2250	2250		12000
Benzo[b]fluroanthene	85.5	911	1690	1690		12000
Benzo[k]fluoranthene	132	132	1390	1390		12000
Benzo[a]pyrene	85	85	**1420**	**1420**	**932.5**	1200
Indeno[1,2,3-c,d]pyrene	112.5	112.5	112.5	770		12000
Dibenz[a,h]anthracene	50	50	50	120		1200
Benzo[ghi]perylene	178	178	178	570		40000

Table A8 - Lower Trent River
Chlorophenol Analyses in Sediment (<20 cm)

Sample ID	05TRSED-11	05TRSED-27	05TRSED-25	05TRSED-38	05TRSED-36	05TRSED-15	05TRSED-02	05TRSED-31	05TRSED-46
Site	05PD01	05PD01	05PD01	05PD02	05PD02	05PD02	05PD02	05PD02	05PD03
Depth	0-5	5-10	10-20	0-5	5-10	10-20	10-20	10-20	0-5
2-Chlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,3,4,6-Tetrachlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,3,5-Trichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,4-Dichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,4-Dimethylphenol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
2,4,6-Trichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,6-Dichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
4-Chloro-3-Methylphenol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
4-Nitrophenol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
m/p-Cresol	0.7	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
o-Cresol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
Pentachlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
Phenol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
2,3,4,5-Tetrachlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,3,5,6-Tetrachlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,3,4-Trichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,4,5-Trichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,3,6-Trichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
3,4,5-Trichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,3-Dichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,5-Dichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
3,4-Dichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
3,5-Dichlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2,4-Dinitrophenol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
4,6-Dinitro-2-methylphenol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15
4-Chlorophenol	0.1	0.25	0.075	0.1	0.075	0.05	0.025	0.05	0.075
2-Nitrophenol	0.2	0.5	0.15	0.2	0.15	0.1	0.05	0.1	0.15

Notes:

MOE (2004), Table 3 Criteria, Residential/Parkland Use, Coarse Soils in a Non-potable Ground Water Condition

US EPA (2005), Risk-Based Concentration Tables, Residential Soils

Table A8 - Lower Trent River
Chlorophenol Analyses in Sediment (<20 cm)

05TRSED-20	05TRSED-39	05TRSED-55	05TRSED-23	05TRSED-47	05TRSED-52	05TRSED-56	05TRSED-40	05TRSED-22	05TRSED-12	05TRSED-44
05PD03	05PD03	05PD04	05PD04	05PD04	05PD05	05PD05	05PD05	05SD01	05SD01	05SD01
5-10	10-20	0-5	5-10	10-20	0-5	5-10	10-20	0-5	5-10	10-20
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2
0.15	0.6	0.4	0.25	0.2	0.4	0.3	0.9	0.4	0.1	0.2
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2
0.075	0.1	0.2	0.125	0.1	0.2	0.15	0.1	0.2	0.05	0.1
0.15	0.2	0.4	0.25	0.2	0.4	0.3	0.2	0.4	0.1	0.2

Table A8 - Lower Trent River
Chlorophenol Analyses in Sediment (<20 cm)

05TRSED-04	05TRSED-19	05TRSED-29	05TRSED-21	05TRSED-53	05TRSED-08	05TRSED-50	05TRSED-17	05TRSED-54	05TRSED-01	05TRSED-06
05SD01	05SD01	05SD02	05SD02	05SD02	05SD03	05SD03	05SD03	05WS01	05WS01	05WS01
10-20	10-20	0-5	5-10	10-20	0-5	5-10	10-20	0-5	5-10	10-20
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35
0.15	0.15	0.1	0.1	0.2	0.25	0.1	0.15	0.5	0.6	0.35
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35
0.075	0.075	0.05	0.05	0.05	0.125	0.05	0.075	0.25	0.125	0.175
0.15	0.15	0.1	0.1	0.1	0.25	0.1	0.15	0.5	0.25	0.35

Table A8 - Lower Trent River
Chlorophenol Analyses in Sediment (<20 cm)

05TRSED-16	05TRSED-24	05TRSED-49	05TRSED-18	05TRSED-07	Maximum Concentration (µg/g)	Screening Standards (µg/g)	Source
05WS01	05WS01	Ponar1	Ponar2	Ponar3			
10-20	10-20	0-10	0-10	0-10			
0.125	0.075	0.1	0.05	0.1	0.25	10	MOE, 2004
0.125	0.075	0.1	0.05	0.1	0.25	920	EPA, 2005
0.125	0.075	0.1	0.05	0.1	0.25	92	EPA, 2005
0.125	0.075	0.1	0.05	0.1	0.25	10	MOE, 2004
0.25	0.15	0.2	0.1	0.2	0.5	140	MOE, 2004
0.125	0.075	0.1	0.05	0.1	0.25	10	MOE, 2004
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.25	0.15	0.2	0.1	0.2	0.5	N.V.	
0.25	0.15	0.2	0.1	0.2	0.5	N.V.	
0.8	0.6	0.9	0.7	0.2	0.9	N.V.	
0.25	0.15	0.2	0.1	0.2	0.5	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	5	MOE, 2004
0.25	0.15	0.2	0.1	0.2	0.5	40	MOE, 2004
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	10	MOE, 2004
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.25	0.15	0.2	0.1	0.2	0.5	4.1	MOE, 2004
0.25	0.15	0.2	0.1	0.2	0.5	N.V.	
0.125	0.075	0.1	0.05	0.1	0.25	N.V.	
0.25	0.15	0.2	0.1	0.2	0.5	N.V.	

Lower Trent River
Metals Analyses in Surface Water

ProUCL: Statistical Analysis for Lead in Sediments			
Number of Valid Samples	31		0.735942
Number of Unique Samples	29	Shapiro-Wilk Test Statisitic	0.929
Minimum	7	Shapiro-Wilk 5% Critical Value	
Maximum	231	Data not normal at 5% significance level	
Mean	53.46452		
Median	44.7		67.10604
Standard Deviation	44.75024	95% UCL (Assuming Normal Distribution)	
Variance	2002.584		
Coefficient of Variation	0.837008		1.063077
Skewness	2.525808	A-D Test Statistic	0.759603
		A-D 5% Critical Value	0.164444
		K-S Test Statistic	0.159975
k hat	1.911982	K-S 5% Critical Value	
k star (bias corrected)	1.748456	Data do not follow gamma distribution	
Theta hat	27.96288	at 5% significance level	
Theta star	30.57812		
nu hat	118.5429	95% UCLs (Assuming Gamma Distribution)	67.89063
nu star	108.4043	Approximate Gamma UCL	68.80611
Approx.Chi Square Value (.05)	85.36942	Adjusted Gamma UCL	
Adjusted Level of Significance	0.0413		
Adjusted Chi Square Value	84.23356		0.907654
		Shapiro-Wilk Test Statisitic	0.929
		Shapiro-Wilk 5% Critical Value	
Minimum of log data	1.94591	Data not lognormal at 5% significance level	
Maximum of log data	5.442418		
Mean of log data	3.695272		77.31864
Standard Deviation of log data	0.808118	95% H-UCL	93.57234
Variance of log data	0.653054	95% Chebyshev (MVUE) UCL	110.2415
		97.5% Chebyshev (MVUE) UCL	142.9848
		99% Chebyshev (MVUE) UCL	
			66.68483
		CLT UCL	70.58079
		Adj-CLT UCL (Adjusted for skewness)	67.71374
		Mod-t UCL (Adjusted for skewness)	67.10604
		Jackknife UCL	66.20601
		Standard Bootstrap UCL	76.67325
		Bootstrap-t UCL	89.1499
		Hall's Bootstrap UCL	66.49677
		Percentile Bootstrap UCL	71.49355
		BCA Bootstrap UCL	88.49864
		95% Chebyshev (Mean, Sd) UCL	103.6579
		97.5% Chebyshev (Mean, Sd) UCL	133.4354
		99% Chebyshev (Mean, Sd) UCL	

Use 95% Chebyshev (Mean, Sd) UCL

Lower Trent River
Metals Analyses in Surface Water

ProUCL: Statistical Analysis for Manganese in Sediments			
Number of Valid Samples	31		0.952709243
Number of Unique Samples	29	Shapiro-Wilk Test Statisitic	0.929
Minimum	170	Shapiro-Wilk 5% Critical Value	
Maximum	760	Data are normal at 5% significance level	
Mean	397.129		
Median	360		441.28158
Standard Deviation	144.8399	95% UCL (Assuming Normal Distribution)	
Variance	20978.58		
Coefficient of Variation	0.364717		0.188288469
Skewness	0.706981	A-D Test Statistic	0.746492975
		A-D 5% Critical Value	0.077249686
		K-S Test Statistic	0.157841625
k hat	7.949654	K-S 5% Critical Value	
k star (bias corrected)	7.201838	Data follow gamma distribution	
Theta hat	49.95551	at 5% significance level	
Theta star	55.14273		
nu hat	492.8785	95% UCLs (Assuming Gamma Distribution)	444.9633418
nu star	446.514	Approximate Gamma UCL	447.7882708
Approx.Chi Square Value (.05)	398.513	Adjusted Gamma UCL	
Adjusted Level of Significance	0.0413		
Adjusted Chi Square Value	395.9989		0.982618189
		Shapiro-Wilk Test Statisitic	0.929
		Shapiro-Wilk 5% Critical Value	
Minimum of log data	5.135798	Data are lognormal at 5% significance level	
Maximum of log data	6.633318		
Mean of log data	5.920049		450.8223185
Standard Deviation of log data	0.368074	95% UCLs (Assuming Lognormal Distribution)	
Variance of log data	0.135478	95% H-UCL	515.0221535
		95% Chebyshev (MVUE) UCL	565.8268963
		97.5% Chebyshev (MVUE) UCL	665.6229759
		99% Chebyshev (MVUE) UCL	
			439.9182634
		CLT UCL	443.4477752
		Adj-CLT UCL (Adjusted for skewness)	441.8321125
		Mod-t UCL (Adjusted for skewness)	441.28158
		Jackknife UCL	438.8485218
RECOMMENDATION		Standard Bootstrap UCL	446.6332797
Data are normal (0.05)		Bootstrap-t UCL	446.8878408
		Hall's Bootstrap UCL	438.2903226
Use Student's-t UCL		Percentile Bootstrap UCL	447.6774194
		BCA Bootstrap UCL	510.5214529
		95% Chebyshev (Mean, Sd) UCL	559.586444
		97.5% Chebyshev (Mean, Sd) UCL	655.9651179
		99% Chebyshev (Mean, Sd) UCL	

Lower Trent River
Metals Analyses in Surface Water

ProUCL: Statistical Analysis for Manganese in Sediments			
Number of Valid Samples	16		0.465662
Number of Unique Samples	15	Shapiro-Wilk Test Statisitic	0.887
Minimum	15	Shapiro-Wilk 5% Critical Value	
Maximum	769	Data not normal at 5% significance level	
Mean	92.825		
Median	20.25		178.4848
Standard Deviation	195.4531	95% UCL (Assuming Normal Distribution)	
Variance	38201.9		
Coefficient of Variation	2.105608		2.780085
Skewness	3.21243	A-D Test Statistic	0.787474
		A-D 5% Critical Value	0.390494
		K-S Test Statistic	0.225583
k hat	0.601586	K-S 5% Critical Value	
k star (bias corrected)	0.530455	Data do not follow gamma distribution	
Theta hat	154.3005	at 5% significance level	
Theta star	174.9912		
nu hat	19.25075		182.1
nu star	16.97457	Approximate Gamma UCL	197.3744
Approx.Chi Square Value (.05)	8.652741	Adjusted Gamma UCL	
Adjusted Level of Significance	0.03348		
Adjusted Chi Square Value	7.983126		0.695525
		Shapiro-Wilk Test Statisitic	0.887
		Shapiro-Wilk 5% Critical Value	
Minimum of log data	2.70805	Data not lognormal at 5% significance level	
Maximum of log data	6.645091		
Mean of log data	3.504037		178.7348
Standard Deviation of log data	1.20822	95% H-UCL	259.5152
Variance of log data	1.459796	95% Chebyshev (MVUE) UCL	200.7268
		97.5% Chebyshev (MVUE) UCL	281.6792
		99% Chebyshev (MVUE) UCL	
			173.1979
		CLT UCL	215.1291
		Adj-CLT UCL (Adjusted for skewness)	185.0252
		Mod-t UCL (Adjusted for skewness)	178.4848
		Jackknife UCL	169.6457
		Standard Bootstrap UCL	585.5757
		Bootstrap-t UCL	520.7495
		Hall's Bootstrap UCL	179.15
		Percentile Bootstrap UCL	230.5875
		BCA Bootstrap UCL	305.815
		95% Chebyshev (Mean, Sd) UCL	397.976
		97.5% Chebyshev (Mean, Sd) UCL	579.0084
		99% Chebyshev (Mean, Sd) UCL	
Use 99% Chebyshev (Mean, Sd) UCL			

APPENDIX B
Environmental Quality Data for Sediments (>20 cm)

Appendix B

List of Tables

Table B1 - Lower Trent River
Conversion if ITEF TEQs to WHO TEQs, Sediment (>20 cm) Data

	Sample Location		TR-01									
	Site											
	Sample Depth (cm)		20-30		20-30		30-40		40-50		50-58	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	1.91	1.91	1.72	1.72	2.38	2.38	3.41	3.41	2.98	2.98
1,2,3,7,8-PnCDD	0.5	1	15.05	30.10	8.83	17.66	13.48	26.96	30.59	61.18	32.89	65.78
1,2,3,4,7,8-HxCDD	0.1	0.1	128.10	128.10	42.95	42.95	85.56	85.56	298.5	298.50	363.94	363.94
1,2,3,6,7,8-HxCDD	0.1	0.1	29.66	29.66	26.28	26.28	38.89	38.89	56.43	56.43	162.82	162.82
1,2,3,7,8,9-HxCDD	0.1	0.1	10.73	10.73	10.78	10.78	14.34	14.34	13.67	13.67	31.49	31.49
1,2,3,4,6,7,8-HpCDD	0.01	0.01	214.95	214.95	228.46	228.46	223.87	223.87	426.34	426.34	1277.61	1277.61
OCDD	0.001	0.0001	123.19	12.32	195.80	19.58	147.08	14.71	245.48	24.55	985.95	98.60
2,3,7,8-TCDF	0.1	0.1	1.81	1.81	1.98	1.98	1.47	1.47	2.34	2.34	4.42	4.42
1,2,3,7,8-PnCDF	0.05	0.05	0.39	0.39	0.50	0.50	0.56	0.56	0.61	0.61	1.12	1.12
2,3,4,7,8-PnCDF	0.5	0.5	4.72	4.72	3.64	3.64	2.91	2.91	6.71	6.71	17.26	17.26
1,2,3,4,7,8-HxCDF	0.1	0.1	3.48	3.48	4.36	4.36	5.08	5.08	7.27	7.27	25.45	25.45
1,2,3,6,7,8-HxCDF	0.1	0.1	4.12	4.12	4.48	4.48	6.60	6.60	8.59	8.59	23.52	23.52
1,2,3,7,8,9-HxCDF	0.1	0.1	0.91	0.91	0.77	0.77	0.99	0.99	0.7	0.70	0.56	0.56
2,3,4,6,7,8-HxCDF	0.1	0.1	2.25	2.25	2.14	2.14	4.53	4.53	3.96	3.96	12.58	12.58
1,2,3,4,6,7,8-HpCDF	0.01	0.01	9.59	9.59	13.30	13.30	17.14	17.14	23.69	23.69	92.81	92.81
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.69	0.69	1.16	1.16	1.21	1.21	2.53	2.53	8.89	8.89
OCDF	0.001	0.0001	4.13	0.41	7.05	0.71	6.33	0.63	11.39	1.14	46.90	4.69
Total TEQ				456.14		380.47		447.83		941.62	3091.19	2194.52

Table B1 - Lower Trent River
Conversion if ITEF TEQs to WHO TEQs, Sediment (>20 cm) Data

	Sample Location		TR-02					
	Site							
	Sample Depth (cm)		20-30		30-40		40-46	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	3.87	3.87	15.86	15.86	1.54	1.54
1,2,3,7,8-PnCDD	0.5	1	30.30	60.60	31.74	63.48	12.20	24.40
1,2,3,4,7,8-HxCDD	0.1	0.1	298.66	298.66	313.56	313.56	92.10	92.10
1,2,3,6,7,8-HxCDD	0.1	0.1	68.00	68.00	140.98	140.98	56.55	56.55
1,2,3,7,8,9-HxCDD	0.1	0.1	22.38	22.38	67.97	67.97	27.28	27.28
1,2,3,4,6,7,8-HpCDD	0.01	0.01	494.11	494.11	1375.91	1375.91	617.92	617.92
OCDD	0.001	0.0001	238.18	23.82	658.29	65.83	383.01	38.30
2,3,7,8-TCDF	0.1	0.1	1.47	1.47	2.01	2.01	1.41	1.41
1,2,3,7,8-PnCDF	0.05	0.05	0.47	0.47	0.60	0.60	0.39	0.39
2,3,4,7,8-PnCDF	0.5	0.5	4.03	4.03	6.04	6.04	6.40	6.40
1,2,3,4,7,8-HxCDF	0.1	0.1	6.61	6.61	12.60	12.60	9.75	9.75
1,2,3,6,7,8-HxCDF	0.1	0.1	6.38	6.38	8.78	8.78	4.81	4.81
1,2,3,7,8,9-HxCDF	0.1	0.1	0.72	0.72	0.65	0.65	N.C.	
2,3,4,6,7,8-HxCDF	0.1	0.1	2.87	2.87	4.30	4.30	3.13	3.13
1,2,3,4,6,7,8-HpCDF	0.01	0.01	20.36	20.36	49.41	49.41	25.33	25.33
1,2,3,4,7,8,9-HpCDF	0.01	0.01	2.01	2.01	3.78	3.78	1.51	1.51
OCDF	0.001	0.0001	8.06	0.81	23.65	2.37	15.37	1.54
Total TEQ				1017.16		2134.12		912.36

Table B1 - Lower Trent River
Conversion if ITEF TEQs to WHO TEQs, Sediment (>20 cm) Data

	Sample Location		TR-03					
	Site							
	Sample Depth (cm)		0-5		5-10		10-20	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	0.84	0.84	0.56	0.56	N.C.	
1,2,3,7,8-PnCDD	0.5	1	3.09	6.18	3.33	6.66	3.80	7.60
1,2,3,4,7,8-HxCDD	0.1	0.1	3.53	3.53	4.19	4.19	2.18	2.18
1,2,3,6,7,8-HxCDD	0.1	0.1	20.07	20.07	10.35	10.35	3.11	3.11
1,2,3,7,8,9-HxCDD	0.1	0.1	4.99	4.99	5.02	5.02	0.95	0.95
1,2,3,4,6,7,8-HpCDD	0.01	0.01	280.19	280.19	86.19	86.19	24.49	24.49
OCDD	0.001	0.0001	143.61	14.36	57.16	5.72	18.80	1.88
2,3,7,8-TCDF	0.1	0.1	1.52	1.52	0.79	0.79	0.34	0.34
1,2,3,7,8-PnCDF	0.05	0.05	0.15	0.15	0.20	0.20	N.C.	
2,3,4,7,8-PnCDF	0.5	0.5	2.20	2.20	1.66	1.66	N.C.	
1,2,3,4,7,8-HxCDF	0.1	0.1	1.95	1.95	1.29	1.29	0.63	0.63
1,2,3,6,7,8-HxCDF	0.1	0.1	0.62	0.62	1.01	1.01	0.47	0.47
1,2,3,7,8,9-HxCDF	0.1	0.1	N.C.		0.12	0.12	N.C.	
2,3,4,6,7,8-HxCDF	0.1	0.1	0.71	0.71	0.86	0.86	0.54	0.54
1,2,3,4,6,7,8-HpCDF	0.01	0.01	7.83	7.83	3.85	3.85	1.26	1.26
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.50	0.50	0.27	0.27	0.11	0.11
OCDF	0.001	0.0001	4.90	0.49	2.20	0.22	0.65	0.07
Total TEQ				346.13		128.96		43.63

Table B1 - Lower Trent River
Conversion if ITEF TEQs to WHO TEQs, Sediment (>20 cm) Data

	Sample Location		TR-07				TR-12			
	Site									
	Sample Depth (cm)		20-30		30-34		20-30		30-35	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	1.81	1.81	2.70	2.70	2.03	2.03	N.C.	
1,2,3,7,8-PnCDD	0.5	1	4.21	8.42	6.05	12.10	N.C.		1.98	3.96
1,2,3,4,7,8-HxCDD	0.1	0.1	24.65	24.65	4.75	4.75	2.88	2.88	0.64	0.64
1,2,3,6,7,8-HxCDD	0.1	0.1	31.56	31.56	26.68	26.68	6.38	6.38	1.54	1.54
1,2,3,7,8,9-HxCDD	0.1	0.1	6.98	6.98	4.39	4.39	0.90	0.90	0.63	0.63
1,2,3,4,6,7,8-HpCDD	0.01	0.01	268.51	268.51	271.25	271.25	50.07	50.07	14.18	14.18
OCDD	0.001	0.0001	321.71	32.17	397.16	39.72	52.41	5.24	12.86	1.29
2,3,7,8-TCDF	0.1	0.1	2.20	2.20	1.94	1.94	1.45	1.45	1.16	1.16
1,2,3,7,8-PnCDF	0.05	0.05	0.57	0.57	0.51	0.51	0.37	0.37	0.29	0.29
2,3,4,7,8-PnCDF	0.5	0.5	6.86	6.86	N.C.		4.09	4.09	2.96	2.96
1,2,3,4,7,8-HxCDF	0.1	0.1	6.72	6.72	3.22	3.22	2.18	2.18	1.37	1.37
1,2,3,6,7,8-HxCDF	0.1	0.1	7.64	7.64	2.53	2.53	1.95	1.95	1.22	1.22
1,2,3,7,8,9-HxCDF	0.1	0.1	0.44	0.44	0.33	0.33	N.C.		N.C.	
2,3,4,6,7,8-HxCDF	0.1	0.1	5.05	5.05	4.06	4.06	0.81	0.81	N.C.	
1,2,3,4,6,7,8-HpCDF	0.01	0.01	26.22	26.22	18.81	18.81	5.24	5.24	3.07	3.07
1,2,3,4,7,8,9-HpCDF	0.01	0.01	1.03	1.03	1.46	1.46	0.17	0.17	0.07	0.07
OCDF	0.001	0.0001	14.76	1.48	15.09	1.51	2.65	0.27	0.4	0.04
Total TEQ				432.31		395.96		84.03		32.42

Table B1 - Lower Trent River
Conversion if ITEF TEQs to WHO TEQs, Sediment (>20 cm) Data

	Sample Location		TR-13					
	Site							
	Sample Depth (cm)		20-30		30-40		40-43	
PCDD Congeners	ITEF TEF Factors	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	1	0.22	0.22	0.71	0.71	N.C.	
1,2,3,7,8-PnCDD	0.5	1	0.52	1.04	1.25	2.50	0.75	1.50
1,2,3,4,7,8-HxCDD	0.1	0.1	N.C.		0.10	0.10	N.C.	
1,2,3,6,7,8-HxCDD	0.1	0.1	N.C.		0.11	0.11	N.C.	
1,2,3,7,8,9-HxCDD	0.1	0.1	0.10	0.10	0.10	0.10	N.C.	
1,2,3,4,6,7,8-HpCDD	0.01	0.01	0.28	0.28	0.59	0.59	0.28	0.28
OCDD	0.001	0.0001	0.32	0.03	0.68	0.07	0.27	0.03
2,3,7,8-TCDF	0.1	0.1	0.07	0.07	0.10	0.10	0.14	0.14
1,2,3,7,8-PnCDF	0.05	0.05	0.06	0.06	0.07	0.07	0.04	0.04
2,3,4,7,8-PnCDF	0.5	0.5	0.38	0.38	0.45	0.45	N.C.	
1,2,3,4,7,8-HxCDF	0.1	0.1	0.37	0.37	0.22	0.22	0.19	0.19
1,2,3,6,7,8-HxCDF	0.1	0.1	0.16	0.16	0.10	0.10	0.09	0.09
1,2,3,7,8,9-HxCDF	0.1	0.1	0.03	0.03	0.04	0.04	N.C.	
2,3,4,6,7,8-HxCDF	0.1	0.1	0.07	0.07	0.10	0.10	N.C.	
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.09	0.09	0.08	0.08	0.07	0.07
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.03	0.03	0.01	0.01	N.C.	
OCDF	0.001	0.0001	0.02	0.00	0.02	0.00	0.01	0.00
Total TEQ				2.93		5.35		2.34

Table B2 - Lower Trent River
WHO TEQ Calculations Sediment (>20 cm) Data

	Sample Location	05TRSED-51		05TRSED-37		05TRSED-48		05TRSED-35	
	Site	05PD01		05PD02		05PD02		05PD02	
	Sample Depth (cm)	25-29		20-30		30-40		45-50	
PCDD Congeners	WHO TEF Factors	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	< 7.1	< 7.1	0.80	0.80	2.20	2.20	4.20	<4.20
1,2,3,7,8-PnCDD	1	17.80	17.80	4.00	4.00	8.00	8.00	12.50	12.50
1,2,3,4,7,8-HxCDD	0.1	39.00	3.90	14.10	1.41	15.20	1.52	11.60	1.16
1,2,3,6,7,8-HxCDD	0.1	209.20	20.92	50.50	5.05	65.40	6.54	96.40	9.64
1,2,3,7,8,9-HxCDD	0.1	82.00	8.20	16.50	1.65	27.50	2.75	41.30	4.13
1,2,3,4,6,7,8-HpCDD	0.01	7611.80	76.12	1968.90	19.69	2762.40	27.62	3762.30	37.62
OCDD	0.0001	72854.50	7.29	20602.00	2.06	39252.10	3.93	38769.90	3.88
2,3,7,8-TCDF	0.1	14.90	1.49	4.30	0.43	13.00	1.30	10.70	1.07
1,2,3,7,8-PnCDF	0.05	5.90	0.30	2.00	0.10	2.10	0.11	4.20	0.21
2,3,4,7,8-PnCDF	0.5	5.80	2.90	2.00	1.00	6.20	3.10	4.20	2.10
1,2,3,4,7,8-HxCDF	0.1	63.60	6.36	12.10	1.21	19.50	1.95	28.40	2.84
1,2,3,6,7,8-HxCDF	0.1	60.30	6.03	10.30	1.03	19.70	1.97	19.80	1.98
1,2,3,7,8,9-HxCDF	0.1	7.20	0.72	< 4.5	<0.45	2.60	0.26	<17.2	<1.72
2,3,4,6,7,8-HxCDF	0.1	41.70	4.17	9.70	0.97	13.20	1.32	27.10	2.71
1,2,3,4,6,7,8-HpCDF	0.01	1888.90	18.89	349.20	3.49	690.80	6.91	929.90	9.30
1,2,3,4,7,8,9-HpCDF	0.01	213.60	2.14	16.50	0.17	33.90	0.34	40.60	0.41
OCDF	0.0001	10232.40	1.02	2216.20	0.22	5080.50	0.51	4672.50	0.47
PCDD/PCDF TEQ (1/2 ND)			178.24		43.28		70.32		90.01
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001								
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001								
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001								
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001								
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005								
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001								
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1								
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001								
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005								
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005								
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01								
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001								
PCB TEQ (1/2 ND)			0.00000		0.00000		0.00000		0.00000
Total TEQ			178.23669		43.27782		70.31926		90.01224

Table B2 - Lower Trent River
WHO TEQ Calculations Sediment (>20 cm) Data

	Sample Location	05TF	05TRSED-32		05TRSED-13		05TRSED-41		05TRSED-45	
	Site	05	05PD03		05PD03		05PD03		05PD03	
	Sample Depth (cm)	2	20-30		30-40		30-40		30-40	
PCDD Congeners	WHO TEF Factors	Concentration (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	< 7.1	1.40	1.40	1.30	1.30	2.20	2.20	<4.5	<4.5
1,2,3,7,8-PnCDD	1	17.80	23.60	23.60	11.50	11.50	11.60	11.60	12.10	12.10
1,2,3,4,7,8-HxCDD	0.1	39.00	34.40	3.44	37.30	3.73	37.40	3.74	43.80	4.38
1,2,3,6,7,8-HxCDD	0.1	209.20	247.40	24.74	186.80	18.68	153.30	15.33	175.40	17.54
1,2,3,7,8,9-HxCDD	0.1	82.00	73.50	7.35	79.50	7.95	53.40	5.34	73.90	7.39
1,2,3,4,6,7,8-HpCDD	0.01	7611.80	9672.20	96.72	6912.00	69.12	6624.40	66.24	7181.00	71.81
OCDD	0.0001	72854.50	97085.70	9.71	75451.70	7.55	68478.60	6.85	77064.10	7.71
2,3,7,8-TCDF	0.1	14.90	23.90	2.39	16.20	1.62	21.50	2.15	19.50	1.95
1,2,3,7,8-PnCDF	0.05	5.90	7.60	0.38	7.70	0.39	8.10	0.41	8.50	0.43
2,3,4,7,8-PnCDF	0.5	5.80	6.50	3.25	6.80	3.40	6.80	3.40	6.30	3.15
1,2,3,4,7,8-HxCDF	0.1	63.60	43.60	4.36	27.10	2.71	39.00	3.90	38.10	3.81
1,2,3,6,7,8-HxCDF	0.1	60.30	36.80	3.68	36.70	3.67	36.90	3.69	42.10	4.21
1,2,3,7,8,9-HxCDF	0.1	7.20	8.60	0.86	<13.6	<1.36	6.60	0.66	4.20	0.42
2,3,4,6,7,8-HxCDF	0.1	41.70	59.00	5.90	30.40	3.04	14.30	1.43	38.40	3.84
1,2,3,4,6,7,8-HpCDF	0.01	1888.90	1683.30	16.83	1198.40	11.98	1265.60	12.66	1442.00	14.42
1,2,3,4,7,8,9-HpCDF	0.01	213.60	134.80	1.35	110.80	1.11	92.90	0.93	59.80	0.60
OCDF	0.0001	10232.40	8358.90	0.84	7237.30	0.72	6530.00	0.65	7551.00	0.76
PCDD/PCDF TEQ (1/2 ND)				206.80		148.47		141.17		154.50
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001									
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001									
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001									
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001									
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005									
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001									
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1									
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001									
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005									
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005									
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01									
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001									
PCB TEQ (1/2 ND)				0.00000		0.00000		0.00000		0.00000
Total TEQ				206.79746		148.46590		141.17486		154.50451

Table B2 - Lower Trent River
WHO TEQ Calculations Sediment (>20 cm) Data

	Sample Location	05TR	05TRSED-30		05TRSED-03		05TRSED-42		05TRSED-28	
	Site	05	05PD03		05PD03		05PD04		05PD05	
	Sample Depth (cm)	2	40-50		50-54		35-39		40-44	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	< 7.1	2.80	2.80	1.40	1.40	5.00	5.00	<5	<5.0
1,2,3,7,8-PnCDD	1	17.80	14.20	14.20	7.20	7.20	29.40	29.40	13.80	13.80
1,2,3,4,7,8-HxCDD	0.1	39.00	73.70	7.37	12.40	1.24	<48.5	<4.85	25.50	2.55
1,2,3,6,7,8-HxCDD	0.1	209.20	318.50	31.85	70.60	7.06	332.60	33.26	127.40	12.74
1,2,3,7,8,9-HxCDD	0.1	82.00	114.40	11.44	21.30	2.13	59.30	5.93	44.60	4.46
1,2,3,4,6,7,8-HpCDD	0.01	7611.80	11955.10	119.55	2506.70	25.07	13068.20	130.68	4756.60	47.57
OCDD	0.0001	72854.50	108256.00	10.83	30801.40	3.08	142393.30	14.24	48344.60	4.83
2,3,7,8-TCDF	0.1	14.90	31.20	3.12	12.50	1.25	30.00	3.00	17.00	1.70
1,2,3,7,8-PnCDF	0.05	5.90	14.60	0.73	4.70	0.24	11.80	0.59	5.60	0.28
2,3,4,7,8-PnCDF	0.5	5.80	10.60	5.30	6.00	3.00	<15.1	<7.55	<5.3	<2.65
1,2,3,4,7,8-HxCDF	0.1	63.60	62.90	6.29	15.90	1.59	99.70	9.97	28.70	2.87
1,2,3,6,7,8-HxCDF	0.1	60.30	92.70	9.27	17.10	1.71	73.30	7.33	17.90	1.79
1,2,3,7,8,9-HxCDF	0.1	7.20	9.60	0.96	7.50	0.75	<33.7	<3.37	<9.9	<0.99
2,3,4,6,7,8-HxCDF	0.1	41.70	28.80	2.88	10.30	1.03	<25.2	<2.52	27.70	2.77
1,2,3,4,6,7,8-HpCDF	0.01	1888.90	2641.80	26.42	581.10	5.81	2234.70	22.35	891.10	8.91
1,2,3,4,7,8,9-HpCDF	0.01	213.60	231.50	2.32	48.00	0.48	183.30	1.83	72.80	0.73
OCDF	0.0001	10232.40	15222.90	1.52	3659.50	0.37	15106.70	1.51	3831.10	0.38
PCDD/PCDF TEQ (1/2 ND)				256.84		63.40		265.09		105.38
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001									
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001									
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001									
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001									
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005									
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001									
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1									
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001									
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005									
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005									
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01									
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001									
PCB TEQ (1/2 ND)				0.00000		0.00000		0.00000		0.00000
Total TEQ				256.84189		63.39909		265.09200		105.38257

Table B2 - Lower Trent River
WHO TEQ Calculations Sediment (>20 cm) Data

	Sample Location	05TF	05TRSED-26		05TRSED-05		05TRSED-10		05TRSED-14	
	Site	05	05SD01		05SD02		05SD03		05WS01	
	Sample Depth (cm)	2	30-34		25-30		35-38		30-35	
PCDD Congeners	WHO TEF Factors	Concentration (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	< 7.1	<0.4	<0.4	1.20	1.20	0.20	0.20	< 0.9	<0.9
1,2,3,7,8-PnCDD	1	17.80	2.10	2.10	6.60	6.60	2.40	2.40	3.60	3.60
1,2,3,4,7,8-HxCDD	0.1	39.00	<0.7	<0.07	8.60	0.86	0.90	0.09	4.30	0.43
1,2,3,6,7,8-HxCDD	0.1	209.20	0.50	0.05	54.20	5.42	2.40	0.24	19.30	1.93
1,2,3,7,8,9-HxCDD	0.1	82.00	<0.6	<0.06	19.70	1.97	1.20	0.12	7.10	0.71
1,2,3,4,6,7,8-HpCDD	0.01	7611.80	9.80	0.10	1922.60	19.23	61	0.61	599.90	6.00
OCDD	0.0001	72854.50	79.40	0.01	22010.70	2.20	590	0.06	5036.10	0.50
2,3,7,8-TCDF	0.1	14.90	4.30	0.43	20.90	2.09	1.80	0.18	5.40	0.54
1,2,3,7,8-PnCDF	0.05	5.90	1.30	0.07	5.90	0.30	0.90	0.05	2.40	0.12
2,3,4,7,8-PnCDF	0.5	5.80	1.50	0.75	5.90	2.95	0.60	0.30	2.00	1.00
1,2,3,4,7,8-HxCDF	0.1	63.60	2.10	0.21	16.70	1.67	1.50	0.15	4.70	0.47
1,2,3,6,7,8-HxCDF	0.1	60.30	2.00	0.20	19.10	1.91	1.00	0.10	6.00	0.60
1,2,3,7,8,9-HxCDF	0.1	7.20	<0.6	<0.06	3.70	0.37	0.40	0.04	1.30	0.13
2,3,4,6,7,8-HxCDF	0.1	41.70	1.50	0.15	9.90	0.99	0.90	0.09	2.50	0.25
1,2,3,4,6,7,8-HpCDF	0.01	1888.90	13.90	0.14	488.40	4.88	13.70	0.14	127.10	1.27
1,2,3,4,7,8,9-HpCDF	0.01	213.60	1.10	0.01	30.00	0.30	1.20	0.01	13.80	0.14
OCDF	0.0001	10232.40	10.50	0.00	2437.00	0.24	53.20	0.01	608.00	0.06
PCDD/PCDF TEQ (1/2 ND)				4.21		53.18		4.78		17.75
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001									
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001									
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001									
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001									
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005									
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001									
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1									
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001									
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005									
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005									
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01									
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001									
PCB TEQ (1/2 ND)				0.00000		0.00000		0.00000		0.00000
Total TEQ				4.21199		53.17977		4.77832		17.75241

Table B2 - Lower Trent River
WHO TEQ Calculations Sediment (>20 cm) Data

	Sample Location	05TR	TR-01								
	Site	05	20-30		20-30		30-40		40-50		50-
	Sample Depth (cm)	2									
PCDD Congeners	WHO TEF Factors	Concentration (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)
2,3,7,8-TCDD	1	< 7.1									
1,2,3,7,8-PnCDD	1	17.80									
1,2,3,4,7,8-HxCDD	0.1	39.00									
1,2,3,6,7,8-HxCDD	0.1	209.20									
1,2,3,7,8,9-HxCDD	0.1	82.00									
1,2,3,4,6,7,8-HpCDD	0.01	7611.80									
OCDD	0.0001	72854.50									
2,3,7,8-TCDF	0.1	14.90									
1,2,3,7,8-PnCDF	0.05	5.90									
2,3,4,7,8-PnCDF	0.5	5.80									
1,2,3,4,7,8-HxCDF	0.1	63.60									
1,2,3,6,7,8-HxCDF	0.1	60.30									
1,2,3,7,8,9-HxCDF	0.1	7.20									
2,3,4,6,7,8-HxCDF	0.1	41.70									
1,2,3,4,6,7,8-HpCDF	0.01	1888.90									
1,2,3,4,7,8,9-HpCDF	0.01	213.60									
OCDF	0.0001	10232.40									
PCDD/PCDF TEQ (1/2 ND)				0.00		0.00		0.00		0.00	
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001		0.0408	4.08E-06	0.04211	4.21E-06	0.09337	9.34E-06	0.17481	1.75E-05	0.14054
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001		2.1119	2.11E-04	2.3898	2.39E-04	9.49898	9.50E-04	9.27158	9.27E-04	9.83901
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001		1.27063	1.27E-04	1.40665	1.41E-04	8.59538	8.60E-04	4.50417	4.50E-04	4.41453
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001		7.75947	7.76E-04	8.56765	8.57E-04	23.01428	2.30E-03	27.74434	2.77E-03	29.37619
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005		0.19008	9.50E-05	0.23193	1.16E-04	0.47437	2.37E-04	0.99863	4.99E-04	0.71414
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001		2.9783	2.98E-04	3.30109	3.30E-04	5.34777	5.35E-04	11.45477	1.15E-03	9.79682
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1		0.04353	4.35E-03	0.0492	4.92E-03	0.06519	6.52E-03	0.13598	1.36E-02	0.13263
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001		0.22895	2.29E-06	0.25081	2.51E-06	0.26711	2.67E-06	0.55987	5.60E-06	0.72771
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005		0.57806	2.89E-04	0.63643	3.18E-04	0.68371	3.42E-04	1.48745	7.44E-04	1.87439
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005		0.12424	6.21E-05	0.13631	6.82E-05	0.15803	7.90E-05	0.33333	1.67E-04	0.37944
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01		0.01072	1.07E-04	0.00983	9.83E-05	0.00706	7.06E-05	0.01039	1.04E-04	0.01218
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001		0.04471	4.47E-06	0.0496	4.96E-06	0.04462	4.46E-06	0.08908	8.91E-06	0.14687
PCB TEQ (1/2 ND)				0.00633		0.00710		0.01191		0.02044	
Total TEQ				0.00633		0.00710		0.01191		0.02044	

Table B2 - Lower Trent River
WHO TEQ Calculations Sediment (>20 cm) Data

	Sample Location	05TR	
	Site	05[-58	
	Sample Depth (cm)	2[	
PCDD Congeners	**WHO TEF Factors**	**Concentration (pg/g)**	**TEQ (pg/g)**
2,3,7,8-TCDD	1	< 7.1	
1,2,3,7,8-PnCDD	1	17.80	
1,2,3,4,7,8-HxCDD	0.1	39.00	
1,2,3,6,7,8-HxCDD	0.1	209.20	
1,2,3,7,8,9-HxCDD	0.1	82.00	
1,2,3,4,6,7,8-HpCDD	0.01	7611.80	
OCDD	0.0001	72854.50	
2,3,7,8-TCDF	0.1	14.90	
1,2,3,7,8-PnCDF	0.05	5.90	
2,3,4,7,8-PnCDF	0.5	5.80	
1,2,3,4,7,8-HxCDF	0.1	63.60	
1,2,3,6,7,8-HxCDF	0.1	60.30	
1,2,3,7,8,9-HxCDF	0.1	7.20	
2,3,4,6,7,8-HxCDF	0.1	41.70	
1,2,3,4,6,7,8-HpCDF	0.01	1888.90	
1,2,3,4,7,8,9-HpCDF	0.01	213.60	
OCDF	0.0001	10232.40	
PCDD/PCDF TEQ (1/2 ND)			0.00
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001		1.41E-05
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001		9.84E-04
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001		4.41E-04
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001		2.94E-03
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005		3.57E-04
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001		9.80E-04
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1		1.33E-02
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001		7.28E-06
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005		9.37E-04
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005		1.90E-04
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01		1.22E-04
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001		1.47E-05
PCB TEQ (1/2 ND)			0.02025
Total TEQ			0.02025

Table B2 - Lower Trent River
WHO TEQ Calculations Sediment (>20 cm) Data

	Sample Location	05TR	TR-07				TR-12			
	Site	05	20-30		30-34		20-30		30-35	
	Sample Depth (cm)	2								
PCDD Congeners	WHO TEF Factors	Concentration (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)	Concentration (pg/g)	TEQ (pg/g)
2,3,7,8-TCDD	1	< 7.1								
1,2,3,7,8-PnCDD	1	17.80								
1,2,3,4,7,8-HxCDD	0.1	39.00								
1,2,3,6,7,8-HxCDD	0.1	209.20								
1,2,3,7,8,9-HxCDD	0.1	82.00								
1,2,3,4,6,7,8-HpCDD	0.01	7611.80								
OCDD	0.0001	72854.50								
2,3,7,8-TCDF	0.1	14.90								
1,2,3,7,8-PnCDF	0.05	5.90								
2,3,4,7,8-PnCDF	0.5	5.80								
1,2,3,4,7,8-HxCDF	0.1	63.60								
1,2,3,6,7,8-HxCDF	0.1	60.30								
1,2,3,7,8,9-HxCDF	0.1	7.20								
2,3,4,6,7,8-HxCDF	0.1	41.70								
1,2,3,4,6,7,8-HpCDF	0.01	1888.90								
1,2,3,4,7,8,9-HpCDF	0.01	213.60								
OCDF	0.0001	10232.40								
PCDD/PCDF TEQ (1/2 ND)				0.00		0.00		0.00		0.00
PCB081- 3,4,4',5-tetrachlorobiphenyl	0.0001		0.11507	1.15E-05	0.18327	1.83E-05	0.03772	3.77E-06	<0.01161	<1.16E-06
PCB077 - 3,3',4,4'-tetrachlorobiphenyl	0.0001		6.07374	6.07E-04	10.21785	1.02E-03	1.40985	1.41E-04	0.12504	1.25E-05
PCB123 - 2'3,4,4',5-pentachlorobiphenyl	0.0001		2.8127	2.81E-04	3.50759	3.51E-04	1.61123	1.61E-04	0.48824	4.88E-05
PCB118 - 2,3'4,4',5-pentachlorobiphenyl	0.0001		18.6238	1.86E-03	25.43343	2.54E-03	13.55255	1.36E-03	4.40697	4.41E-04
PCB114 - 2,3,4,4',5-pentachlorobiphenyl	0.0005		0.5473	2.74E-04	0.71993	3.60E-04	0.27997	1.40E-04	0.07994	4.00E-05
PCB105 - 2,3,3'4,4'-pentachlorobiphenyl	0.0001		7.45828	7.46E-04	11.00995	1.10E-03	4.82767	4.83E-04	1.51128	1.51E-04
PCB126 - 3,3'4,4',5-pentachlorobiphenyl	0.1		0.08855	8.86E-03	0.09635	9.64E-03	0.05484	5.48E-03	0.01829	1.83E-03
PCB167 - 23',44',55'-hexachlorobiphenyl	0.00001		0.42331	4.23E-06	0.51535	5.15E-06	0.55403	5.54E-06	0.23007	2.30E-06
PCB156 - 2,3,3'4,4'5-hexachlorobiphenyl	0.0005		1.12431	5.62E-04	1.42164	7.11E-04	1.46823	7.34E-04	0.61916	3.10E-04
PCB157 - 2,3,3'44'5'-hexachlorobiphenyl	0.0005		0.2433	1.22E-04	0.2983	1.49E-04	0.28765	1.44E-04	0.10506	5.25E-05
PCB169 - 3,3'4,4'55'-hexachlorobiphenyl	0.01		0.01096	1.10E-04	0.00845	8.45E-05	0.017	1.70E-04	0.01459	1.46E-04
PCB189 - 233'44'55'-heptachlorobiphenyl	0.0001		0.07202	7.20E-06	0.07389	7.39E-06	0.07818	7.82E-06	0.04426	4.43E-06
PCB TEQ (1/2 ND)				0.01344		0.01599		0.00883		0.00304
Total TEQ				0.01344		0.01599		0.00883		0.00304

Table B3 - Lower Trent River
PCB Analyses in Sediment (>20 cm)

Environment Canada			Environment Canada		
Sample Location	**Sample Depth (cm)**	**Concentration in Sediment (ng/g) (Total PCB)**	**Sample Location**	**Sample Depth (cm)**	**Concentration in Sediment (ng/g) (Total PCB)**
05TRSED-32	20-30	110	05TRSED-34	20-30	270
05TRSED-13	30-40	320	05TRSED-42	35-39	440
05TRSED-41	30-40	230	05TRSED-43	20-30	130
05TRSED-45	30-40	220	05TRSED-05	25-30	450
05TRSED-30	40-50	570	05TRSED-33	20-30	410
05TRSED-03	50-54	200	05TRSED-14	30-35	120
05TRSED-28	40-44	240	Maximum Concentration (ng/g)		**570**
05TRSED-37	20-30	70	MOE (2004) Table 3 Residential Standard, Coarse Soil, Non-Potable Ground Water Condition (ng/g)		**5000**
05TRSED-48	30-40	20			
05TRSED-35	45-50	180			

Table B4 - Lower Trent River
Metals Analyses in Sediment (>20 cm)

Metal (ug/g)	Environment Canada Sample Locations									Maximum Concentration (µg/g)	95th Percentile Concentration (ug/g)	Screening Standards	
	05TRSED-51	05TRSED-35	05TRSED-03	05TRSED-42	05TRSED-28	05TRSED-26	05TRSED-05	05TRSED-10	05TRSED-14				
	05PD01	05PD02	05PD03	05PD04	05PD05	05SD01	05SD02	05SD03	05WS01				
	25-29 cm	45-50 cm	50-54 cm	35-39 cm	40-44 cm	30-34 cm	25-30 cm	35-38 cm	30-35 cm			(µg/g)	Source
Aluminum	10800	10600	16500	17100	11700	22700	19000	25100	16700	25100		31200	EPA, 2005
Antimony	2.8	7.2	3.8	5.9	7	2.2	4.6	0.3	0.4	7.2		40	MOE 2004
Arsenic	7	15	16	9	3	6	6	4	3	16		20	MOE 2004
Barium	88	85	104	105	62	156	136	144	105	156		750	MOE 2004
Beryllium	0.63	1.09	**1.35**	1	0.44	0.96	0.68	0.88	0.62	**1.35**	**1.246**	1.2	MOE 2004
Cadmium	0.7	1.2	0.8	1	0.7	0.9	1.5	0.4	0.5	1.5		12	MOE 2004
Chromium	41	31	40	54	42	39	65	42	36	65		750	MOE 2004
Cobalt	5.5	6.4	9	6.8	5.3	7.9	7.1	7	5.8	9		40	MOE 2004
Copper	180	**313**	211	**440**	**401**	76	197	25	18	**440**	**424.4**	225	MOE 2004
Lead	77.4	162	112	114	124	124	146	48	68.7	162		200	MOE 2004
Manganese	296	136	222	223	228	365	415	424	286	424		640	MOE 2004
Mercury	0.215	0.792	1.21	0.76	0.178	0.462	0.813	1.4	0.389	1.4		10	MOE 2004
Molybdenum	1	1.9	1.5	1.5	0.8	0.9	1.4	<0.5	<0.5	1.9		40	MOE 2004
Nickel	17.5	21.3	24.9	22	20.4	21.4	19.9	16.1	12.5	24.9		150	MOE 2004
Selenium												10	MOE 2004
Strontium	143	87	133	114	127	111	82	129	132	143		18800	EPA, 2005
Thallium	0.225	0.496	0.673	0.492	0.2	0.377	0.34	0.29	0.221	0.673		4.1	MOE 2004
Titanium												124000	EPA, 2005
Uranium	0.97	0.87	0.94	0.87	0.76	1.08	1.07	0.96	0.72	1.08		92	EPA, 2005
Vanadium	30	25	44	33	28	38	39	42	30	44		200	MOE 2004
Zinc	122	127	130	142	121	163	199	93	89	199		600	MOE 2004

Table B5 - Lower Trent River
PAH Analyses in Sediment (>20 cm)

PAH (ng/g)	Environment Canada Sample Locations									
	BQ10	05TRSED-14 05WS01	TR-01	TR-01	TR-01	TR-01	TR-07	TR-07	TR-12	TR-12
	25-30cm	30-35cm	20-30cm	30-40cm	40-50cm	50-58cm	20-30cm	30-34cm	20-30cm	30-35cm
Napthalene	<50	30	0	0	0	0	0	62.7	0	0
1-Methylnaphthalene	<81.2	20	0	0	0	0	0	0	0	0
2-Methylnaphthalene	<72.6	30	0	0	0	0	0	0	0	0
Acenapthylene	<83.2	20	0	0	0	0	0	0	0	138
Acenapthene	1470	90	0	0	0	0	193	633	0	163
Fluorene	1590	50	0	0	0	113	184	595	116	213
Phenanthrene	15200	340	371	544	306	571	710	2750	487	1130
Anthracene	2340	80	84.8	137	74.6	226	214	712	178	439
Fluoranthene	18500	480	694	1090	831	1030	1410	2900	1120	4310
Pyrene	14000	430	758	1050	1190	1220	1600	2540	1190	4090
Benz[a]anthracene	2790	200	527	663	633	719	775	779	796	2540
Chrysene	2330	140	336	519	479	643	725	747	668	3130
Benzo[b]fluroanthene	1720	230	396	575	667	1020	650	643	728	4090
Benzo[k]fluoranthene	1160	80	405	551	555	819	593	486	719	3390
Benzo[a]pyrene	999	150	339	530	578	808	561	539	640	**3750**
Indeno[1,2,3-c,d]pyrene	<225	90	286	409	470	723	327	276	383	1380
Dibenz[a,h]anthracene	<100	-	0	0	120	163	0	0	103	362
Benzo[ghi]perylene	<356	80	0	0	407	559	0	0	0	1140

Table B5 - Lower Trent River
PAH Analyses in Sediment (>20 cm)

PAH (ng/g)	Maximum Concentration (ng/g)	95th Percentile Concentration (ng/g)	MOE (2004) Table 3 Residental Standards (ng/g), Coarse Soil, Non-potable Ground Water Condition
Napthalene	62.7		40000
1-Methylnaphthalene	20		280000
2-Methylnaphthalene	30		280000
Acenapthylene	138		1000000
Acenapthene	1470		100000
Fluorene	1590		350000
Phenanthrene	15200		40000
Anthracene	2340		28000
Fluoranthene	18500		40000
Pyrene	14000		250000
Benz[a]anthracene	2790		40000
Chrysene	3130		12000
Benzo[b]fluroanthene	4090		12000
Benzo[k]fluoranthene	3390		12000
Benzo[a]pyrene	**3750**	**2512.05**	1200
Indeno[1,2,3-c,d]pyrene	1380		12000
Dibenz[a,h]anthracene	362		1200
Benzo[ghi]perylene	1140		40000

Table B6 - Lower Trent River
Chlorophenols Analyses in Sediment (>20 cm)

Sample ID	05TRSED-14	Screening Standards (µg/g)	Source
Site	05WS01		
Depth (cm)	30-35		
2-Chlorophenol	--	10	MOE, 2004
2,3,4,6-Tetrachlorophenol	--	920	EPA, 2005
2,3,5-Trichlorophenol	--	92	EPA, 2005
2,4-Dichlorophenol	--	10	MOE, 2004
2,4-Dimethylphenol	--	140	MOE, 2004
2,4,6-Trichlorophenol	--	10	MOE, 2004
2,6-Dichlorophenol	--	N.V.	
4-Chloro-3-Methylphenol	--	N.V.	
4-Nitrophenol	--	N.V.	
m/p-Cresol	0.30	N.V.	
o-Cresol	--	N.V.	
Pentachlorophenol	--	5	MOE, 2004
Phenol	--	40	MOE, 2004
2,3,4,5-Tetrachlorophenol	--	N.V.	
2,3,5,6-Tetrachlorophenol	--	N.V.	
2,3,4-Trichlorophenol	--	N.V.	
2,4,5-Trichlorophenol	--	10	MOE, 2004
2,3,6-Trichlorophenol	--	N.V.	
3,4,5-Trichlorophenol	--	N.V.	
2,3-Dichlorophenol	--	N.V.	
2,5-Dichlorophenol	--	N.V.	
3,4-Dichlorophenol	--	N.V.	
3,5-Dichlorophenol	--	N.V.	
2,4-Dinitrophenol	--	4.1	MOE, 2004
4,6-Dinitro-2-methylphenol	--	N.V.	
4-Chlorophenol	--	N.V.	
2-Nitrophenol	--	N.V.	